

Product Oriented Safety and Health Management

U.S. DEPARTMENT OF TRANSPORTATION

Maritime Administration

in cooperation with

Todd Pacific Shipyards Corporation

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FOREWORD

In shipyards which feature modern product organizations, workers, supervisors, and managers conduct safety and health matters as part of their everyday work just as they implement production routines. Their record of unprecedented levels of productivity and quality is accompanied by relatively few lost-time accidents and work related health problems. They have proven that quality is linked to productivity and that both are linked to safety and health in the work force.

Much of their safety and health measures are rooted in organization of work in accordance with a product work breakdown structure which enables people to "work smarter, not harder" (Deming). Consistent with Group Technology concepts, work is classified by problem areas. This facilitates establishing prerequisites for safety, productivity, and quality per specific problem category. Also, most work is scheduled by zone/stage so that different teams are not unintentionally working in the same place at the same time.

Where product organizations are employed, as in shipyards and other works operated by Ishikawajima-Harima Heavy Industries, Co., Ltd. (IHI) of Japan, experiences thus far show that small groups of people organized to match work stages in production lines are excellent sources of suggestions for improvements, particularly regarding safety. Thus, emphasis is applied to small group activities (Quality Circles) because they began with concerns for safety and soon overflowed into quality and productivity issues.

This publication, with other National Shipbuilding Research Program publications which describe IHI's manufacturing methods, endorses the need for modern product organizations applied for shipbuilding. A product organization enables a safety and health program to coincide with a company's operational organization. This facilitates formulation of a corporate safety and health policy with inputs from normal feedback channels, decentralization in implementation, and increased effectiveness.

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“Know your stuff. Take care of your men.”

Douglas S. Freeman

1.0 INTRODUCTION

1.1 General

Research into various aspects of the product-oriented shipbuilding approach developed by Ishikawajima-Harima Heavy Industries Co., Ltd. (IHI) continues to reveal profound advantages as compared to the traditional system-by-system approach. The product work breakdown structure employed facilitates decentralization of many responsibilities. The net result is improved corporate performance. Ships of better quality are built with less man-hours while maintaining what is perhaps the world's best safety and health record for such industrial endeavor.

IHI's safety and health (S&H) program is implemented systematically by the entire corporation. The demonstrated performance of the program is proof that, while instilling S&H consciousness in each employee is important, impressive records can only be achieved when S&H methodology is well planned and decentralized, and when group activities (e.g., Quality Circles) are active. Further, it is essential that the organizational structure for S&H be coincident with the operational structure. In shipyards, product organization fulfills such requirements to a degree that is impossible with functional organizations.

1.2 Pertinent History in Japan

As human resources are the most valuable assets of a company, S&H management is regarded as one of the major tasks of corporate management throughout Japanese industries. Numerous steps have been taken by the Japanese Government and individual industries to establish regulations, standards, and countermeasures to secure the S&H of workers.

The Japanese Government enacted statutes for labor protection as part of the Labor Standards Act of 1947. Subsequently, the rapid growth in Japan's economy triggered rapid industrial renovation and expansion. Worker casualties increased in proportion to the increase in labor force. In order to counter this upsetting trend, the Government enacted the Safety and Health Act of 1972 for the purpose of:

- 0 formulating safe and comfortable job environments to maintain employees S&H,
- 0 requiring corporations to establish S&H management systems and control organizations within corporate structures and to clarify such responsibilities.

Corporations began, not only to observe the S&H standards specified by laws and regulations, but to go beyond the laws in order to prevent casualties and to ensure the S&H of employees. Also, employees began to recognize obligations to observe all S&H requirements aimed at the prevention of both accidents and illnesses.

In the shipbuilding industry, major shipyards started reviewing their own S&H activities as a consequence of the Labor Standards Act of 1947. They initiated safety checks, case studies of casualties, etc., and exchanged information between themselves. In about 1950 they caused the Shipbuilders Association of Japan to establish the Labor and Safety Ad-hoc Committee. Their objective was to exchange information, at a national level, concerning ways to prevent tuberculosis and other serious diseases. In **1951**, the committee was divided into a Safety Section and a Health Section which were charged with creating shipbuilding industry-wide standards. Thus, a S&H management system, criteria, and standards, applicable to the whole industry were established and streamlined.

The national activities greatly contributed to the prevention of casualties and diseases in individual shipyards. During 1966, under the slogan "safety and Health Worthy of the World's Leading Shipbuilding Country", the National Shipbuilding S&H Week was created for the purpose of carrying out S&H checks, etc. In recent years the national initiatives include studies of new social problems, such as, occupational diseases, middle-age and senility problems, etc.

1.3 Pertinent IHI History

In Japan, until about 1947 injuries were generally attributed to the workers themselves. In 1950 this notion changed. Safety issues were regarded as a matter to be undertaken by management. In other words, casualties were no longer considered as attributable to the carelessness of workers. Instead, they were regarded as being attributable to lack of safety measures by management.

This introspection led IHI to the establishment of a new S&H management concept. The basic policy became one of challenging management to establish safety policies, standards, and control systems which prevent casualties by avoiding dangerous work sites.

As an extension of safety management, health measures were also assumed as a management responsibility. The objective is to prevent illnesses by periodic health examinations, improvements in work environments, etc.

In 1955, IHI established consolidated S&H rules to replace those that sporadically existed in the various shipyards and other works. These rules are the origin and framework of IHI's current S&H standards. In 1960, S&H responsibilities were taken from the Personnel Department and assigned to a newly created S&H Department.

Another result of this movement was the collaboration of management and organized labor on safety issues. In 1967, the Labor and Management Cooperation System was established to set up basic safety policies. In the same year, management and labor representatives held a meeting for Special Safety Measures and in 1969, the Special Safety and Health Check Month Program commenced.

Although each shipyard was basically responsible to manage and control S&H activities, the corporate headquarters played the role to support, coordinate, and consolidate company-wide S&H issues and/or problems that could not be handled by a single yard. The head office acted as a coordinator to streamline and establish rules, standards, and management systems, employees health diagnosis programs, environmental-control measures for the prevention of health hazards, etc. Such activities gradually improved IHI's safety record. In the late sixties, IHI achieved and continues to maintain a premier safety position, particularly among Japan's shipbuilders. See Figure 1-1.

In 1967, voluntarily, IHI's Yokohama Shipyard created a No-drop Campaign (ND) which soon spread to other shipyards. The movement, aimed at preventing falls from high places, featured employee participation in management of safety activities. Suggestions for improving safety were brought up by workers through group activities where individuals could debate issues and develop ideas. Such groups set safety targets for themselves and challenged them systematically. [1]

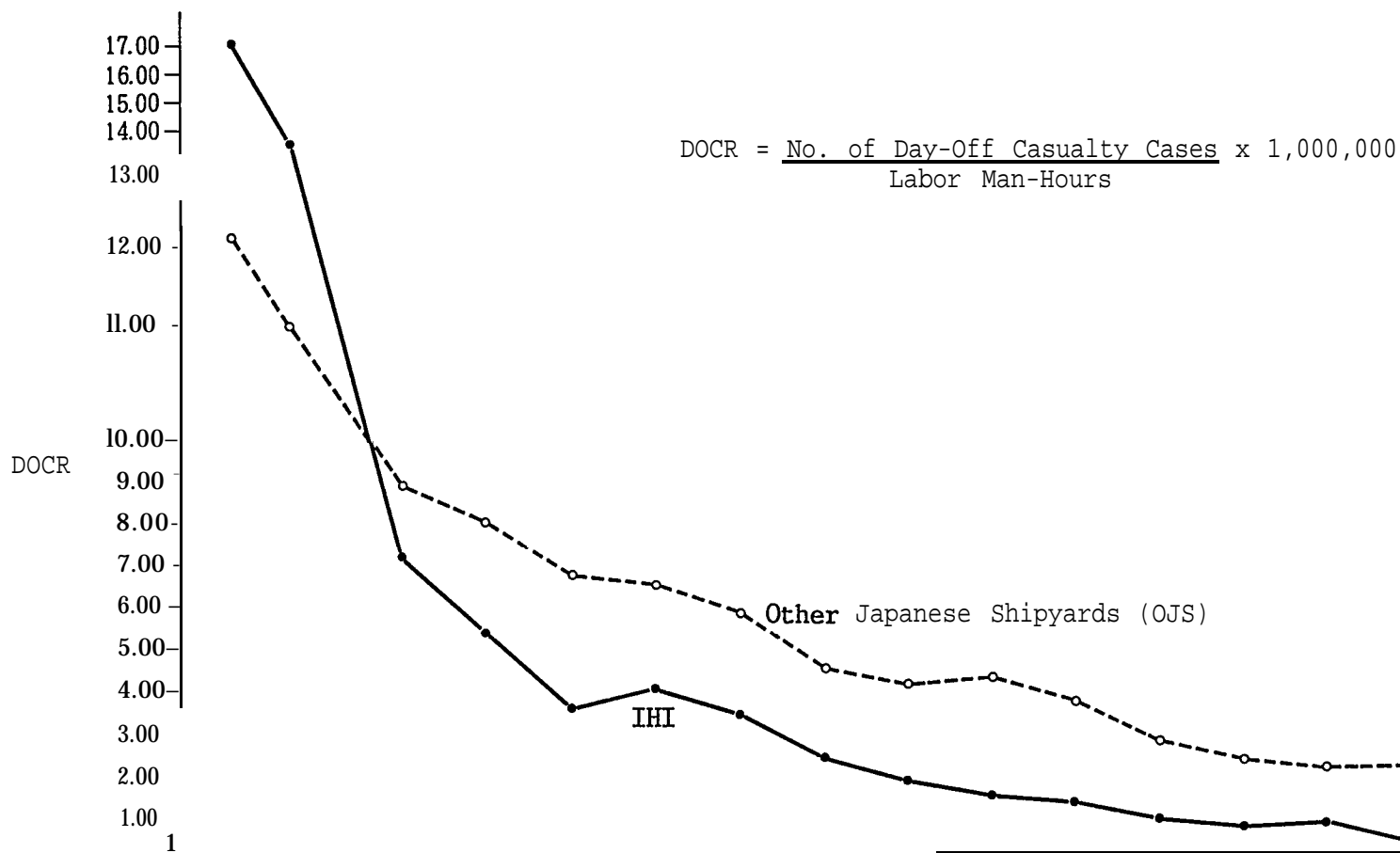
This approach is facilitated by product organizations in which groups of workers are permanently associated with particular work stages or problem areas (work flows). Individual workers are only relocated for schedule control, i.e., workers are temporarily shifted from a work flow that is ahead of schedule to assist one that is behind schedule. Regardless of such temporary assignment, they retain affiliation with a "home" group.

Because the late sixties involved building increasingly larger ships, the ND movement was significant enough to play an important role in further enhancing the safety management and control system in IHI. One result was the establishment of a communication channel between engineering and production to incorporate safety measures in end-product designs. Also, safety measures were pursued through improvements in work flows and accuracy-control methods.

[1] The world's first rationalized shipyard, IHI Yokohama, was completed in October 1964 for building and repairing ships of 200,000 deadweight-tons (dwt) capacity. The shipbuilding facilities and their arrangement were committed for organized work flows in accordance with a product work breakdown structure. With only one building dock (330x52x11 meters) having two 120-ton cranes and one 30-ton crane, the yard delivered 510,063 dwt (6 ships) in 1967. By 1969 the delivery rate increased to 1,452,258 dwt (6 ships).

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YEAR	I 65	I 66	I 67	68	69	70	71	72	73	74	75	76	77	78	79	80	81
I H I	17.52	13.77	7.35	5.39	3.49	4.04	3.36	2.44	1.76	1.50	1.44	1.09	0.81	0.82	0.60	1.41	0.62
O J S	12.19	11.16	8.99	8.05	6.78	6.57	5.83	4.61	4.23	4.32	3.78	2.77	2.49	2.23 ; 2.28	2.33	1.94	

FIGURE 1-1: Day-Off Casualty Rate (DOCR) for IHI shipyards vs. other Japanese shipyards.

In 1972, Five Precepts for Safety were proposed by union representatives as follows:

- o Safety is top priority.
- o Don't do dangerous work; don't allow dangerous work.
- o Provide advance measures to eliminate casualty causes.
- o Follow safety rules and standards.
- o Make voluntary efforts to prevent casualties.

A safety drive, motivated by the efforts of management and each shipyard union, which incorporates the precepts continues to this day.

Subsequently, rules and systems which form the framework of IHI's S&H management program were reviewed. Major achievements are:

- o S&H Standards

The rules and standards were reviewed and a new standard was established in 1976. The new standard clarifies basic policies relating to S&H.

- o Health Diagnosis Practice Standard

The review also resulted in the 1979 establishment of the Health Diagnosis Practice Standard.

- o Company Safety and Health Committee

This committee was created in 1980 to deliberate on and determine the company's safety and health management policies and ways to practice the policies.

The foregoing is an historical account of the progress of IHI's S&H activities. Management, workers, and union representatives were the three major constituents in the development process. Their combined efforts, not only resulted in significant improvements in safety records, they also, contributed to improvements in productivity.

2.0 IHI SAFETY AND HEALTH PROGRAMS

2.1 Company Policies

The facade of formal organization for S&H matters within IHI is organized on six levels. Figure 2-1 shows the various committee and group levels. The backdrop to this formal approach to S&H is an overall product organization. The various industrial divisions of IHI are an example of product organizations which became pervasive in American industries, other than shipbuilding, between 1949 and 1969. In each of the yards which comprise IHI's Shipbuilding and Offshore Division, work groups are organized to fit the product work break down employed. Also, the way work is grouped forms the basic levels of formal S&H organization.

Overall S&H strategy is established every December by IHI's highest S&H entity, i.e., the Company's S&H Committee. The committee members are the managers of the various product divisions, i.e., of the Shipbuilding and Offshore Division, Aerospace and Aircraft Division, and the Machinery Division. Within each division there may be more than one factory, e.g., the Shipbuilding and Offshore Division consists of four shipyards. The three division managers are the overall S&H policy makers.

The Company S&H Committee establishes an umbrella policy for the whole company. The subordinate five levels of S&H organization apply and adapt the Committees policy to their specific circumstances. Usually a policy is continued for four years to better measure its affects. When a policy is continued from one year to the next, S&H targets are always raised.

S&H programs can only be achieved when targets are consistently reflected throughout all committee and group levels and are finally accomplished in routine work.

2.1.1 Company S&H Committee

The Company S&H Committee is responsible for the following:

- o overall company S&H management policy,
- o assigning the functions for S&H control,
- o setting company S&H targets, and
- o improvement in the S&H management system.

A chronical of IHI's S&H policy steps is presented in Figure 2-2.

2.1.2 Special S&H Countermeasure Committees

Each Special S&H Countermeasure Committee is made up of top-level company and labor union representatives corresponding to a Division of the Company. Each carries out studies and establishes policies on the following:

- o S&H management system and organization,
- o safety education and training,
- o safety countermeasures for facilities including those of subsidiaries,
- o adjustment and improvement of job-site environments, and
- o other S&H subjects of importance to the company and union.

In Japan, typically, labor unions are not divided by crafts. Instead, parent unions are organized to correspond with corporations and are subdivided geographically. For example, the employees of IHI's shipyard and two other works in Kure, Japan belong to the same local chapter of the union. Thus, typically in Japan, a shipyard has only one union which, in most cases, is a closed union. This means that everyone, excluding managers, **must be a union member.**

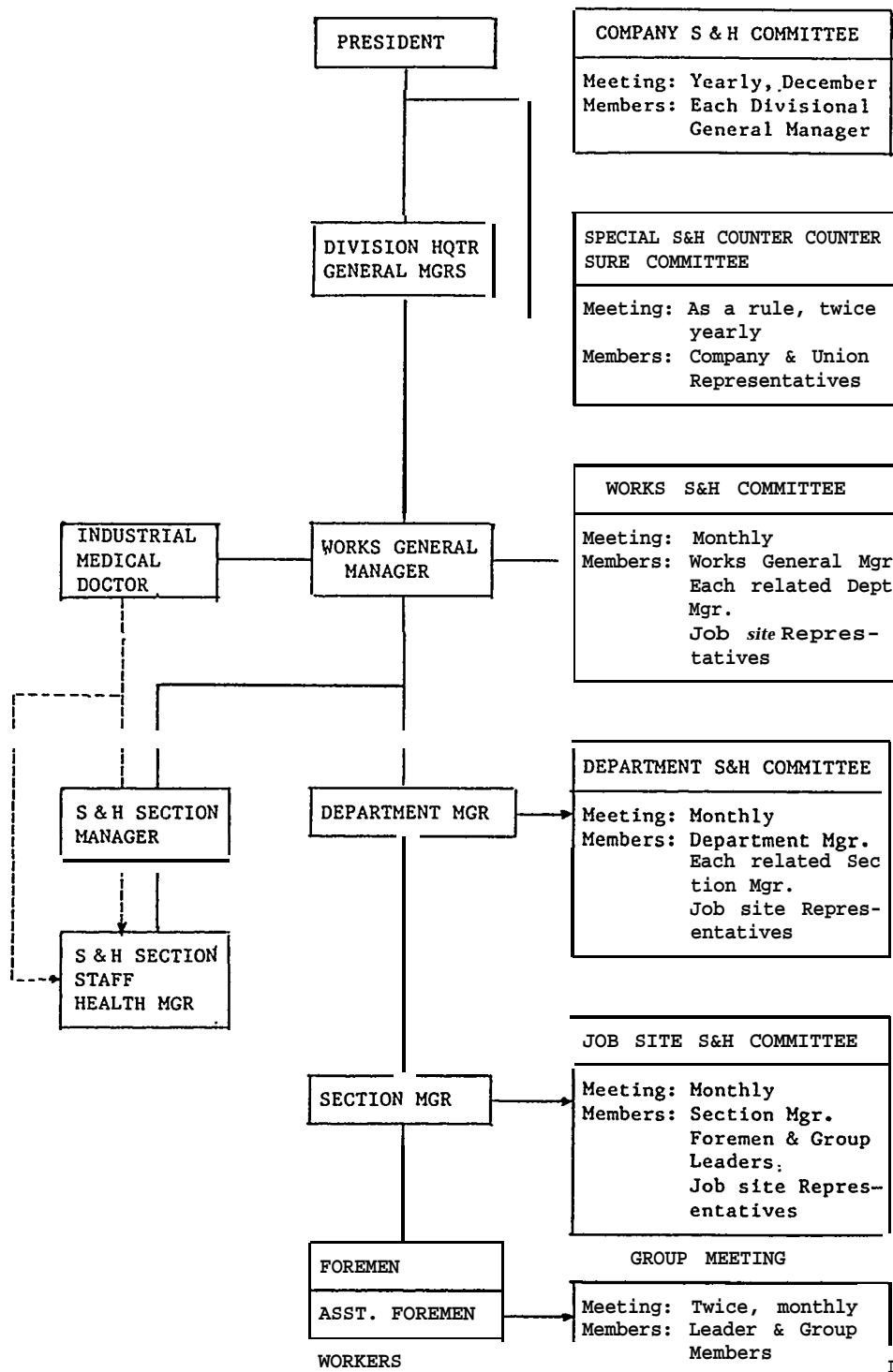


FIGURE 2-1: S&H MANAGEMENT ORGANIZATION.

YEAR	POLICY TARGETS	PRIORITY MEASURES
1969	1. Drastic reduction of deaths. 2. Reduce DOCR by 30%. 3. Reduce SDODR by 10%. <u>Special Priority Targets:</u> 1. Drastic reduction of accidents by falls. 2. Drastic reduction of explosions, fires, and poisonings (including by organic solvents)	1. Establishing a S&H management system. 2. Indoctrinating in S&H rules and regulations. 3. Checking and improving job-site environments. 4. Repeating S&H education and training. 5. Promoting health control of individuals.
1972	1. Reduce deaths to zero. 2. Reduce DOCR by 20% more. 3. Reduce SDODR by 5% more.	1. <u>Safety Control:</u> a. Preventing major casualties; falls, crane mishandlings, explosions, fires, poisoning, etc. b. Promoting systematic safety control; incorporate safety measures in design. c. Developing and promoting safety work standards. 2. <u>Health Control:</u> a. Carrying out health control of individual workers along job lines. b. Promoting mental health control. c. Educating managers and supervisors in health management. d. Foremen and Assistant Foremen checking workers' health conditions during routine morning meetings at job sites.

FIGURE 2-2: CHRONICLE OF S&H MANAGEMENT POLICY (1 of 3).

YEAR	POLICY TARGETS	PRIORITY MEASURES
1975	<u>Basic Policies:</u> 1. Implement Five Precepts of Safety. 2. Plan scheme for zero deaths. 3. Plan scheme for voluntary health control concepts. <u>Targets:</u> 1. Reduce major casualties to zero. 2. Reduce DOCR to 0.5 or less.	1. Preventing potential casualty causes. a. Completing elimination of casualties caused by facilities. b. Preventing casualties caused by unsafe worker conduct. c. Preventing casualties caused by falls, dropping of heavy objects, crane mishaps, etc. 2. Preventing group casualties by fires, explosions, etc. 3. Propagating and following up on Safety Work Grade Standards. 4. Promoting and following up on S&H education.
1979	1. Reduce major casualties to zero. 2. Reduce DOCR to 0.5 or less.	1. <u>Strengthening S&H control to cope with changes in work environments:</u> a. Propagating basics of S&H control to cope with changes in job conditions, e.g. , relocation of shops, etc. b. Preventing casualties by precise planning and production engineering when new facilities are installed, new tools are used, etc. c. Reviewing and updating S&H standards to cope with changes in work practices, etc. 2. <u>Providing adequate measures to eliminate causes of casualties:</u> a. Eliminating causes of group casualties, e.g., explosions, fires, and organic-solvent poisoning.

FIGURE 2-2: CHRONICLE OF S&H MANAGEMENT POLICY (2 of 3).

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1979 cont'd.		<ul style="list-style-type: none"> b. Propagating basic conduct requirements for working in high places and preventing accidents by falls. c. Preventing repeats of similar accidents by studying causes of past accidents. <p>3. <u>Carrying out S&H education meetings at job sites:</u></p> <ul style="list-style-type: none"> a. Carrying out safety education when new facilities, etc., are installed. b. Carrying out health education to prevent occupational diseases.
1982	<ul style="list-style-type: none"> 1. Reduce major casualties to zero 2. Reduce DOCR to 0.5 or less. 	<p>1 <u>Drastically reducing accidents by falls:</u></p> <ul style="list-style-type: none"> a. Intensifying promotion of the Fall Accidents Prevention Committee. b. Establishing specific countermeasures to prevent accidents by falls. c. Promoting prevention of group casualties caused by explosions, fires, poisoning, etc.

$$= \text{Day-Off Casualty Rate} = \frac{\text{No. of Day-Off Casualty Cases}}{\text{Labor Man-Hours}} \times 1,000,000$$

$$\text{SDODR} = \text{Sick Day-Off Daily Rate} = \frac{\text{Total No. of Sick Days}}{(\text{No. of Total Employees}) \times (\text{No. of Actual Workdays})} \times 100$$

The situation is quite different from that of shipyards in the West many of which have several unions to deal with. Naturally, a single union facilitates communications between management and labor regarding how to constantly improve employees welfare and productivity.

Under such circumstances, S&H management becomes more of a union major objective. Pertinent policies are taken up at union meetings for integration with company policies. In order to reflect the union's S&H ideas in the company policy, the union's general meetings are usually held 2 or 3 months prior to the Company S&H Committee's meetings.

Figure 2-3 shows union requirements listed chronologically so that they may be readily compared to the company's policies shown in Figure 2-2.

Actions determined by a Special S&H Countermeasure Committee during select years, are described in Figure 2-4.

2.1.3 Shipyard (Works) S&H Committees

The shipyard manager, department managers, and special job-site representatives comprise the membership. The committee meets monthly for determining at least the following:

- o S&H management programs,
- o improvements of safety measures, facilities, work environments, etc.
- o Preparation of implementation plans for S&H programs,
- o methods for preventing danger and/or health hazards when adopting new machinery, equipment, facilities, materials, methods, etc.,
- o results of periodic health diagnosis programs and countermeasures,
- o investigations of on-the-job accidents and countermeasures to prevent repetition, and
- o methods for propagating the notion of S&H among employees.

2.1.4 Department S&H Committees

These committees, one for each department including the repair department, establish S&H policies involving subcontractors workers who work within the shipyard or do work for the shipyard at the subcontractors' facilities. Membership in each includes the concerned department and shop/section managers and special job-site representatives. [1]

The committees address:

- o S&H subjects at work sites particularly where coordination is required between subcontractor and shipyard personnel,
- o guidance and assistance to subcontractors for S&H education of their workers,
- o at least all of the following when shipyard and subcontractor workers are mixed on the same job:
 - elimination of unsafe work conditions, e.g., adjustments and/or improvements of facilities, equipment, and work environments,
 - review of S&H standards,
 - propagation of S&H ideas among workers,
 - investigation of causes of casualties and countermeasures to prevent repetition.

2.1.5 Job Site S&H Committees

Each of these committees is concerned with section matters, meets monthly, and includes as members the appropriate section manager, foremen, group leaders, and any special job-site representatives. The committee is charged with establishing concrete plans to promote and propagate S&H activities at job sites including:

- o detection and removal of unsafe work conditions,
- o ways to disseminate correct methods on how to check, adjust and use S&H devices to workers,
- o improvements in work environments,

[1] Regarding usage of "shop/section", as noted in the NSRP publication "Product Work Breakdown Structure - Revised December 1982", the different types of work, due to inherent differences, are hull construction, outfitting, and painting. Each is subdivided by "fabrication" and "assembly". Painting is rationalized as assembly work (joining a pigment to a surface is regarded as an assembly process). In IHI, this distinction also applies to the organization of production people. Shops deal with fabrication such as the manufacture of hull parts and pipe pieces. Sections are responsible for assembly work only. Shop has the connotation of a fixed work place. Section implies flexibility and movement to wherever work is to be performed. Hereafter in this publication, wherever the word "section" is used, "shop" is also implied.

YEAR	UNION'S MAJOR S&H REQUIREMENTS
1969	<ol style="list-style-type: none"> 1. Safety first, production second! The company should avoid establishing unrealistic production schedules that compel unreasonable and excessive efforts by workers. 2. Priority should be given to countermeasures to prevent major casualties, such as, workers falls, crane mishandling, falling objects, collapses, explosions, and ruptures. 3. At least once each month, a joint management/union safety patrol team should inspect job sites in order to detect conditions which are hazardous to S&H. Problems uncovered should be immediately resolved with appropriate countermeasures. 4. Designate a Special Safety Day at the start of each month. On this day encourage all workers to pay special attention to and make best efforts to observe safety measures and to achieve safety targets. 5. Designate June of each year as a Special S&H Check Month. During this month make special efforts to eliminate major casualties and accidents.
1975	<ol style="list-style-type: none"> 1. Reinforce and perfect S&H committees at each works and job site. 2. Promote various S&H activities: (a) Establish a Special S&H Countermeasure Committee. (b) Establish a S&H Check Month and a Year End S&H Reinforcement Month. 3. Provide health management services: (a) Plan preventative checks to maintain employees' health. (b) Detect and/or measure hazardous job-site environments and implement appropriate countermeasures leading to improvements.
1982	<ol style="list-style-type: none"> 1. Cause the Special S&H Committee to address and solve S&H problems. 2. Reinforce the activities of the S&H committees at works, departments , and job sites. 3. Promote various activities concerning safety countermeasures: (a) Designate Special S&H Check Month and Year End Safety Reinforcement Month. (b) Raise positive proposals to remove causes of major casualties and provide double and triple countermeasures through the management/union safety patrol program.

FIGURE 2-3: Union's S&H Management Requirements.

YEAR	ACTIONS DETERMINED BY THE SPECIAL S&H COUNTERMEASURE COMMITTEE
1969	<p>1. Management and Union Joint Patrol:</p> <p>Joint meetings to be held at each regional works complex, between local management and union personnel to determine and discuss safety issues.</p> <p>2. Establishment of Green Cross Day (a green cross is the symbol of the safety movement):</p> <p>On the first workday of each month, Green Cross Day shall be enforced throughout the company.</p> <p>3. Establishment of Special Safety Check Month:</p> <p>Carry out overall checks at job sites in June as preparation for 1-7 July National Safety Week.</p>
1975	<p>1. As a countermeasure to casualties caused by falling objects, inaugurate an Overhead Crane Project in order to eliminate crane handling errors.</p> <p>2. Hold meetings in each region to establish and implement practices for checking safety measures, correcting unsafe situations, and cleaning job sites within working hours.</p>
1982	<p>1. In 1981 a major accident, a fall from a high place happened. Investigators concluded that managers and supervisors in charge of accident prevention programs were responsible because their controls were insufficient. Tighter safety management and control responsibilities were assigned to each shipyard manager.</p>
On-going Items	<p>1. Practice of Joint Management and Union Safety Patrol:</p> <p>To be carried out twice yearly.</p> <p>2. Establishment of the Special Safety Check Month:</p> <p>To be implemented in June of each year.</p> <p>3. Promotion of the Five Precepts of Safety</p>

FIGURE 2-4: Special S&H Countermeasure Committee.

- o ways to get workers to observe S&H standards,
- o investigations of casualties and accidents at job sites and the determination of countermeasures, and
- o other S&H subjects.

2.1.6 Small Group Activities

Small group activities are stimulated when two conditions exist. First, they result from a product organization which creates natural groups of workers by organizing work in terms of production lines within process flows dedicated to specific product classes (interim products in shipbuilding). Secondly, they result from relatively great amounts of data that are made available to each group concerning how their work processes are performing, how the group is performing relative to S&H, etc. As a consequence small groups of workers in a product organization are better able to assimilate techniques for identifying and solving problems than their counterparts in functional organizations.

Specifically, group meetings are a means to address subjects included in the agendas of Job Site S&H Committees. The meetings afford opportunities for workers to obtain information concerning the circumstances surrounding them, to express and exchange their opinions, make suggestions, etc. In short, the meetings encourage workers to participate in company activities.

Meetings are held whenever a problem comes up for which exchange of workers' opinions could probably yield a mutually agreed upon solution. The meeting is not limited to group members. Depending on the subject, various levels of supervision, a section manager in some cases, may be requested to attend. In IHI's experience, subjects raised by a small group meeting in most cases are adopted as section opinions. That is, superficial matters do not encumber Small Group Activities. Thus, the groups' suggestions often lead to updating of safety standards, improvements in equipments and tools, additional safety standards to be incorporated in designs, etc.

The mission of Small Group Activity evolved from just concentration on safety issues. But, safety was soon found to be linked to productivity and quality. Thus the mission of Small Group Activity grew to include much of that which is associated with Quality Circles and Statistical Control.

2.2 Physical Care and Check-Up

2.2.1 Health Diagnosis Program Objectives

Most people are health conscious but sometimes are unaware of job-site environments which can have adverse effects on health. Thus, the company has a responsibility to take due care of employees by exerting efforts to examine and improve work environments and to develop and implement diagnosis programs to detect illnesses or diseases before they become serious. Special health examinations are carried out for workers assigned to jobs for which hazardous environments cannot be totally eliminated.

The objectives of the health diagnosis programs are to:

- o detect sickness and disease at a primitive stage so that treatment will be more effective (in most cases a sick individual does not recognize early symptoms),
- o detect and segregate people having contagious diseases to prevent infection of others.
- o advise ill people of their health conditions so that they can make good decisions regarding cures they prefer.

IHI's health diagnosis program is compulsory.

2.2.2 Specific Programs

The health diagnosis programs employed by IHI are either required by law or imposed by the company.

The programs required by law are:

o Entry Health Diagnosis

Each new employee must be diagnosed when entering into an employment contract.

o Periodic Health Diagnosis

Health diagnosis must be exercised for each worker at least once per year.

o Special Health Diagnosis

Employees engaged in special jobs, e.g., handling silicons, organic solvents, lead, etc., must be diagnosed at least twice per year.

The program voluntarily imposed by IHI is:

o Adult Health Diagnosis

"Adult Disease" is a general term used in Japan which includes hypertension, cancer, heart diseases, etc., that usually first appear when people become of middle-age (employees 40-years of age or older may elect to receive additional examinations, e.g., stomach, blood precipitation, liver, and cardiac organs).

The above programs are exercised as part of the company's S&H program and are included in its yearly events schedule.

2.2.3 Job Related S&H Programs

S&H education for workers at their jobs is carried out by foremen and assistant foremen. Education programs include:

o Newly Assigned Workers

S&H matters relating to assigned job classification.

o Workers Shifted From Other Jobs (temporary and permanent reassignment)

Further education is provided if the new job is quite different from the previous job.

o When Something New is Introduced

Special orientation is provided to familiarize the workers new machines, different products, different materials, different methods, etc.

o When Work Standards are Revised or Introduced

Education is applied repeatedly at every opportunity.

o Education During Morning Meeting

Essential points and precautions relating to the day's jobs, examples of actual casualties/accidents, delivery of educational notices from the S&H Section, etc.

o Routine S&H and Work Technique Education/Guidance

Provided as a matter of routine during the progress of work.

o Specially Dangerous and Hazardous Work

Special instructions and guidance for S&H are provided.

o Guidance for Cleaning Work Sites

Guidance applies to arranging tools and equipment, passageways, disposal of scrap and unused material, etc., that relate to continued safe operation.

2.3 Suggestion and Appraisal System

2.3.1 Safety Commendation System

The Safety Commendation System started in IHI around 1967. Safety targets were designated and used as a basis for competition between shipyards and other works. The President's Prize was presented to the winner of the Inter-Works Safety Competition. The commendation ceremony was held in the presence of the company's top executives, demonstrating the company's high degree of interest in employee safety. This safety competition was successful in further stimulating the safety consciousness of the various works.

By 1975, IHI's safety record showed remarkable improvement and most of the works had received commendations by that time. Since then, safety competition was changed to the present Safety Commendation System having revised rules and criteria as follows:

Safety Commendation: President's Prize'

Period calculated: 6-months
(January - July)
(July - December)

Criteria: DOCR = 1.20 or less

Intensity ratio = 0.03 or less [2]

Safety Commendation: Presidents Special Prize

Period Calculated: 12 months
(January - December)

Criteria: same as above

[2] Day-Off Casualty Rate (DOCR) $\frac{\text{No. of Day-Off Casualty Cases}}{\text{Labor Man-Hours}} \times 1,000,000$

Intensity Ratio = $\frac{\text{Total Number of Lost Hours}}{\text{Overall Labor Man-Hours}}$

The awards associated with a commendation are:

- o a testimonial and a token for commemoration, and an appropriate President's Banner to be flown near the entrance of the winning works.

In addition to above company commendation system, an industry commendation system for safety is managed by the Shipbuilding Association of Japan.

2.3.2 Commendations Awarded to Small Groups

Commendations awarded to small groups separately acknowledge:

- o small groups which achieve their targets (prize grades are "Excellent", "Good", and "Appreciation of Effort"), and
- o an excellent suggestion or proposal (prize grades are divided into-four levels: A, B, C, and D).

Awards consist of tokens for commemoration and prize money. Applications for commendations are prepared and submitted by group leaders. Depending upon the grade of the proposal, evaluation is done by the section, department, or works manager.

3.0 IMPLEMENTATION OF SAFETY AND HEALTH PROGRAMS

3.1 S&H Management

In order to enable every employee to participate, it is essential to continuously sponsor employee S&H education. As an organization, it is important to hold safety meetings by section and groups so that all workers have opportunities to participate in discussions.

The S&H Management Standards, which are the nucleus of the company's S&H control system, are related to the company's rules and the labor agreement as shown in Figure 3-1. The labor agreement is a fundamental understanding between the company and organized labor which establishes terms and conditions of employment. Employee's S&H assurances are included.

As stated in the agreement, the company gives assurances to the union that it will exert full effort to prevent occurrences of casualties at job sites, maintain health of union members, take necessary action to secure S&H at job sites while honoring the union's opinions and suggestions. On the other hand, the union assures the company that it will exert full effort to persuade union members to enhance their consciousness for safety. Accordingly, the agreement establishes a cooperative relationship between the company and the union which furthers the promotion of S&H programs and activities.

3.2 S&H Management Activity and the Roles of Line Managers

3.2.1 Share of Responsibility

As S&H management is a company-wide activity, managers are responsible to promote and implement the various programs. Activity starts with the establishment of policy by the corporate top management, develops into specific programs by the next level of management, and then is implemented by various

levels of the management structures in the different works and shipyards. Programs are determined and planned upstream and implemented downstream. Figure 3-2 shows the roles and responsibilities of various levels of management, of foremen, and of assistant foremen for development, planning, and implementation of programs.

As previously shown in Figure 2-1, the S&H manager of each works or shipyard, occupies a staff position relative to a general manager. In a specific shipyard the S&H Manager acts for the General Manager in further development and planning of yard S&H programs. Specific responsibilities include:

- o planning of S&H related enlightenment and educational programs and, with the approval of the General Manager, their implementation,
- o publicizing features of S&H programs, clerical work related to labor accident insurance, and
- o routine work associated with S&H commendation programs, etc.

An industrial medical doctor, also in a staff position to each general manager, is responsible for the following:

- o health diagnoses,
- o medical/health education activities,
- o investigate causes of work related health troubles and provide remedial measures to prevent repetition, and
- o periodic patrol of work sites, etc., to detect environments that are hazardous to health.

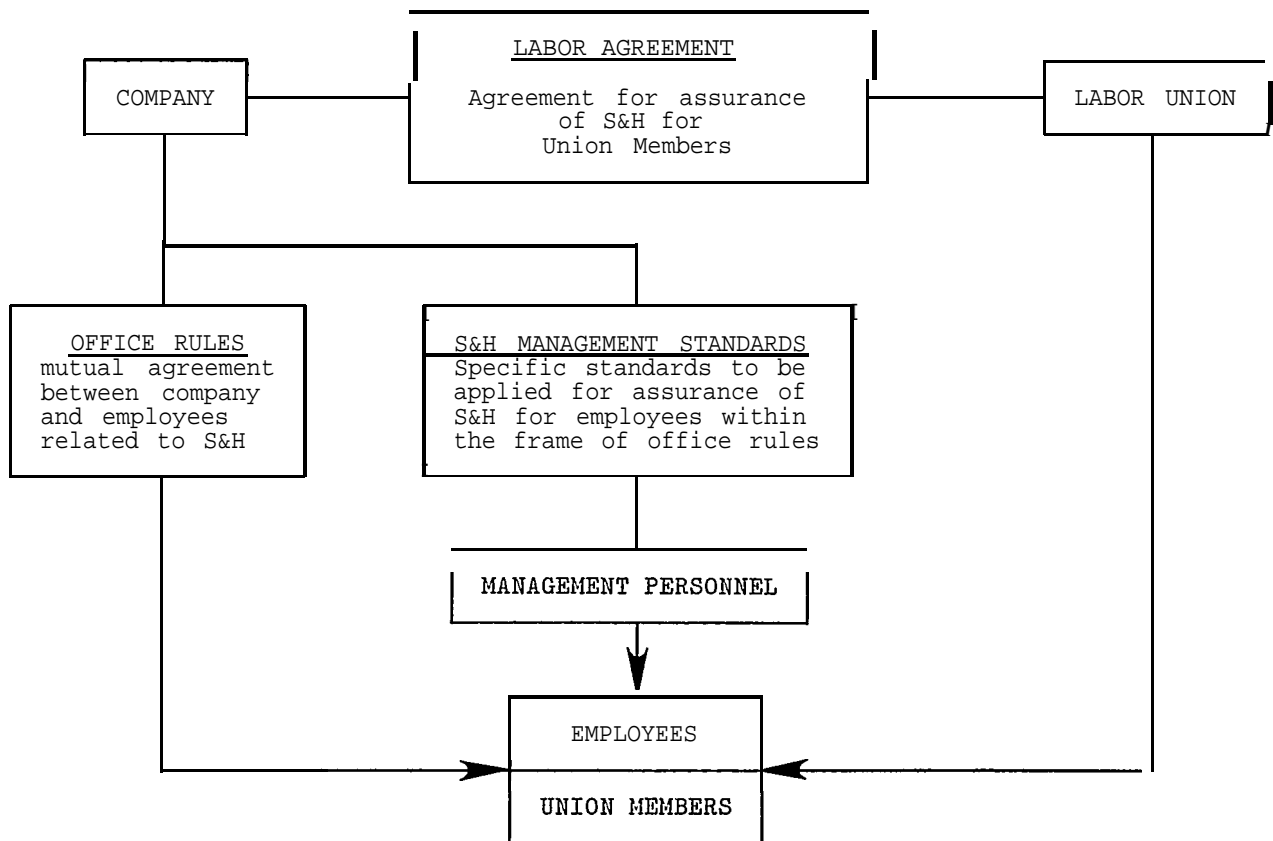


FIGURE 3-1: Relationship Between Company, Labor Union, and Employees. Per the labor agreement, the Company gives assurance to the Union that it will apply full effort to prevent the occurrences of casualties at job sites and to maintain the health of union members.

The general manager of each shipyard and works also acts as the General S&H Manager, required by law, and assigns health control managers within the organization to carry out the following activities under the guidance of the Industrial Medical Doctor:

- o periodic patrol of work sites,
- o identify people having health problems and direct them to the Industrial Medical Doctor,
- o check work environments hazardous to health,
- o improve work conditions, facilities, equipment, etc., which affect health,
- o conduct routine health education, consultations and other necessary services which contribute to maintaining employee health,
- o prepare statistical data of deaths, injuries, sicknesses, days-off involved, etc.
- o provide hygienic measures as appropriate when different crafts have to work in the same space at the same time,

- o maintain records, health logs, etc., and
- o other subjects concerning health.

3.2.2 Special Safety Care Groups

Generally safety control is conducted as an intrinsic part of operational structures. Thus, much of the safety programs and activities are the responsibilities of sections and groups. As they cannot alone fulfill all safety operations, the following supplemental measures are taken:

- o Appointment of General Work Instructors

Especially when several different types of work must take place at the same place during the same time, usually on board, an overall leader is appointed as general instructor to coordinate the different groups so as to prevent accidents. Typical assignments of responsibility areas are shown in Figure 3-3.

SAFETY AND HEALTH MANAGEMENT ACTIVITY							
PRIMARY ACTION		WORKS/YARDS GENERAL MGR.	DEPARTMENT MANAJAGER	SECTION MANAGER	FOREMAN	ASSISTANT FOREMAN	S & H SECTION MANAGER
Actions to prevent safety and health hazards	Safety & Health Management Policy	Policy decision (Works/Yards level)	Policy decision (Dept. level)	policy decision (Section level)	Execution	Execution	Planning (Works/Yards level)
	Building, facility, machinery, equipment, environment: Examination, improvement Hazard prevention action	Decision of improvement plan (Works)	Decision of improvement plan (Dept.)	Decision of improvement plan Section)	Execution	Execution	Assistance
	Patrol of job sites	Execution	Instruction	Guidance	Execution	Execution	Assistance
	S&H operation standard		Execution	Execution	Execution	Execution	Execution
	Machinery, etc., voluntary periodical checks		Examination	Examination	Planning	Planning assistance	Adjustment
	Protectors, first aid gears		Instruction	Instruction Affirmation	Execution (Guidance)	Execution	Affirmation
	Actions to be taken for imminent hazards	Decision of action		Planning of action	Guidance for proper use	Trial use, diffusion of usage	Selection and instruction for application
Actions to promote safety and health education	Safety and health education	Decision of program (W/Y level)	Decision of program (Dept level)	Decision of program (Sect level)	Execution	Execution	Program planning (W/Y) & promotion
	Special education on safety items stipulated by law	Ditto.	Ditto.	Ditto.	Ditto.	Ditto.	Assistance in program planning & exwcution

FIGURE 3-2: RESPONSIBILITY ASSIGNMENTS FOR S&H MANAGEMENT (1 of 2).

SAFETY AND HEALTH MANAGEMENT ACTIVITY		WORKS/YARDS GENERAL MGR.	DEPARTMENT MANAGER	SECTION MANAGER	FOREMAN	ASSISTANT FOREMAN	S & H SECTION MANAGER
PRIMARY ACTION	SECONDARY ACTION			Instructions to take exams to take exams Execution	Instructions to take exams and follow-up Execution	Instructions to take exams and follow-up Execution	Program plan- ning and exe- cution Planning and Execution
Health control	Health diagnosis Other necessary actions	Decision of program Decision of program	Execution	Investigate and report Execution	Investigate and take first aid action Planning and execution of countermeasure	Investigate and take first aid action Assistance for planning and execution of counter- measure	Investigate and report Guidance and execution
Actions to prevent recurrence of accidents and casualties	Investigations on cause of accidents and casualties Action to prevent recurrence	Approval of report Approval of countermeasure	Decision of countermeasure	Study of countermeasure			

FIGURE 3-2: RESPONSIBILITY ASSIGNMENTS FOR S&H MAN EMEN (2 of 2)

o Specialized Committees

The S&H Section shown in Figure 2-1 as staff to a general manager, is in a position to provide assistance in safety control which is carried out by the line management organization. People in the staff organization have sufficient knowledge of S&H activities, but usually lack knowledge of circumstances at work sites. Therefore, ad hoc committees are organized to solve particular S&H problems. The committees are made up of people from the line organization having pertinent process expertise supplemented by a S&H specialist from the staff to act as an advisor/observer.

The following are typical such ad-hoc committees:

- o Crane Accident Prevention Committee
- o Electric-Shock Accident Prevention Committee
- o Falling Accident Prevention Committee
- o Committee for Development and Use of Safety Equipment

3.3 Small Group Activities Related to S&H

3.3.1 Background

Small Group Activity is a movement which IHI introduced stemming from awareness of human need for self expression. The approach better enables managers to supplement their own experiences with employees' experiences for the purpose of fulfilling the imperative need to constantly improve operations. Such improvements are necessary for the prosperity of both the company and its employees.

In IHI, small worker groups are a natural consequence of work organized along product lines. Thus the introduction of Small Group Activities required only identification of group leaders and objectives and some pertinent training in problem identification and solving. Group end products are specifically identified problems and proposed solutions for consideration by management.

Foreman	Assistant Foreman
All Accommodation Spaces	Each deck in the Accommodation Space
All Hold Space	Each Hold
Entire Engine-Room Space	Each Engine-Room Level
Entire Upper-Deck Space	A subdivision of the Upper Deck (divided transversely or longitudinally into 2 to 4 subdivisions)
Entire Outside Shell	A subdivision of the Outside Shell (port, starboard, bow, stern, bottom, etc.)
FIGURE 3-3: Typical assignments of foremen and assistant-foremen as general instructors to coordinate different types of work that must take place in the same space during the same time.	

More specifically the structure and activities of groups are as follows:

- o Each group consists of a small number of workers, usually five to ten, assigned to the same work stage. All are given opportunity to express opinions and fully utilize their capabilities and personalities. Each group elects a Group Leader who acts, for a six month period, as a representative for meetings and other communications with management. [1]
- o Each group, voluntarily, sets up its own targets consistent with the peculiarities of assigned work and targets for the shipyard. In order to nurture a sense of unity, each member is encouraged to demonstrate full capacity and become confident of participation in the company's operation.
- 10 When a problem is defined or a target is challenging, all members participate in finding a solution.

As a consequence of human nature, when there is group achievement, participants are motivated to further develop their problem-solving capabilities.

3.3.2 Safety Programs for Small Group Activities

The Small Group Activity of IHI started as part of a Zero Defect (ZD) movement which also addressed assurances for safety. As elsewhere, the ZD approach, not having an analytical foundation, began to wither. Small Group Activity then became a signifi-

cant part of the Total Quality Control (TQC) movement which has as a basis the same statistical approach as employed for Accuracy Control (A/C). During this history, major aims and goals of Small Group Activity were changed. But safety assurance still remains as a top priority.

The most important and essential prerequisite to ensure safety at a job site is to vitalize the work atmosphere so as to let employees feel composed and content in their work. As another prerequisite, all design and production engineering skills and know-how must be utilized to the maximum extent to secure safety in all aspects of the manufacturing system. A third prerequisite is to insure that work is performed per safety standards and authorized methods. Emphatically, not one of these prerequisites is sufficient without the others.

In order to promote safety programs through Small Group Activity, the following points are taken into consideration to avoid disrupting smooth operations:

- o each group must be formed as a unit of operation,
- o targets of a group must be spontaneously selected by its members based on their personal experiences (to assist their selections, foremen help groups to break down the targets established by their section so that each group can establish targets on the basis of work packages),

[1] Regardless of the free elections, in IHI's Kure Shipyard, assistant foremen have usually been elected as group leaders. In IHI's Aioi Shipyard, workers are usually elected. Neither trend has yet to be proven sufficiently better than the other to interfere with workers' election preferences.

- o each group must reform targets into numerical figures by analyzing points where emphasis should be placed to challenge and achieve targets,
- o foremen must attend group meetings to provide information to group leaders as necessary, to answer questions raised by group members, etc.

One example of the foregoing is a target to reduce the number of injuries to fingers. Each group then identifies the kinds of work performed by the group which causes finger injuries. Discussion is facilitated by use of a Cause and Effect (Fish bone) Chart and Pareto Diagram which group members have been trained to use for identifying all potential causes and for categorizing causes in their order of severity. If, for example, attention focuses on how to secure a pipe length when it is to be cut, discussion produces ideas for improved jigs or for modifying the work process to perform cutting before bending as cutting pipe pieces when they are straight is safer and more productive. [2]

Group leaders and foremen play important roles in promoting and executing safety programs through Small Group Activities. In order to avoid problems, much is dependent on foremen's abilities to provide assistance to group leaders and on leaders' abilities to comprehend and translate information as required to fulfill S&H objectives. A foreman who attends a group meeting must have observed the group's S&H activities in routine operations in, order to ascertain problems that may be encountered when adopting new or revised S&H procedures. Further, the foreman must help group members to acknowledge problems and find ways to resolve them.

3.3.3 Role of Small Group Leaders

Unless S&H matters are incorporated in work instructions and schedules, it is hard to ensure S&H at job sites. Thus, essential points for S&H are positively incorporated in process instructions and schedules so that they can be properly observed. Then, the most important role of a group leader is to at least:

- o fully understand work instructions and schedules,
- o obtain advanced knowledge of risks involved in contemplated work,

- o predict and estimate achievement of program targets, and
- o instruct group members in how to avoid casualties and accidents.

Further, if a group leader is also an assistant foreman he should convey to the group, and if not the assistant foreman should insure that the group understands:

- o the orders to perform work,
- o how to do the work, and
- o by whom the work should be done, and when the work is scheduled for completion.

For the above purposes bi-weekly, weekly, and daily schedules, work instructions, and other documents are employed.

During the preparation of schedules, consideration should be given to the following safety related measures:

- o obtain full understanding of the work a group is to accomplish,
- o study procedures for performing the work,
- o identify risks involved,
- o review accident records relative to similar work,
- o use safety regulations, work standards etc. ,
- o use S&H countermeasures, and
- o in order to avoid confusion, concentrate the start of S&E measures on only two or three safety items at a time.

For safe operations, at least the following should be considered:

- o housekeeping at work sites should ensure sufficient illumination, ventilation, footholds, lifting devices, etc.
- o checks should be made for the proper installation and/or operation of safety features on machinery and equipment, particular those that are new models,
- o confirm method of operation with the objectives of using-safe methods and avoiding unsafe conduct,

[2] For a description of statistical methods as employed by small groups, including Cause and Effect and Pareto Charts, see "Guide to Quality Control" by Dr. K. Ishikawa; Asian Productivity Organization, Aoyama Dai-ichi Mansions, 4-14 Akasaka 8-chome, Minato-ku, Tokyo 107, Japan; Second Revised Edition 1982, ISBN-92-833-1036-5 (softbound).

- o use approved protection devices especially when new materials are involved,
- o accurately plan and control implementation of work, especially when two different kinds of work must take place in the same space at the same time,
- o educate new members of the group,
- o reeducate group members when work processes are changed,
- o check the qualifications of workers who are to be assigned to specialized jobs,
- o formally appoint work leaders, signal men, etc.,
- o display suitable instructions, warnings, etc. at work sites, and
- o apply special consideration to subcontractors' workers assigned to assist the group.

In order to effectively convey safety instructions to group members, a group leader should at least consider:

- o studying the instructions beforehand to acquire a clear understanding of their objectives,
- o using educational aids, e.g., a blackboard, drawings, or models, to further understanding by group members,
- o explaining the purpose, reasons, and importance of essential safety measures and obtain group members' acknowledgements of understanding,
- o encouraging group members to take notes and letting them repeat essential points, and
- o questioning group members as means to check the degree of their understanding.

After instructions are delivered, as follow-up, a group leader should at least:

- o Patrol work sites as work is being performed paying special attention to whether or not S&H instructions are being properly followed (when appropriate, notice is given to workers that are not following instructions for which there was previous agreement, questions are addressed to determine why instructions are not being followed, pertinent rediscussion with group members starts, and/or the instructions are repeated),

- o if necessary, initiate requests to revise existing, or develop new, work standards, and
- o exploit morning and bi-monthly group meetings to let group members discuss essential matters concerning the previous day's and/or the current day's work.

3.4 Standards in S&H Management

3.4.1 S&H Standards

IHI's S&H standards are maintained both to meet law requirements and to constantly improve S&H by exploiting experiences to date.

Standards based on governmental law are:

- o standards to prevent accidents caused by machinery, equipment, vehicles, and other facilities,
- o standards to prevent accidents caused by falling,
- o standards to prevent accidents caused by electricity, heat, and other energy sources,
- o standards to prevent accidents caused by explosives and flammable materials,
- o standards to prevent health hazards caused by toxic materials, gases, powder, dust, lack of oxygen, etc.,
- o standards to prevent health hazards caused by radiation, high temperature, low temperature, ultrasonic waves, vibration, etc.,
- o standards to prevent accidents by maintaining passages, floor space, ventilation, lighting, etc., and
- o standards to prevent accidents resulting from special types of work.

Standards voluntarily established are:

- o safety design standards to assure safety at work sites,
- o S&H management standards, and
- o work process standards incorporating S&H features.

3.4.2 Safety Design Standards

As a ship is a huge and complex structure, many work sites on-board are inherently unsafe and can cause fatal or other serious casualties. Safety Design Standards are an outgrowth of discussions between design and production people for seeking ways to prevent casualties during shipbuilding processes.

The aim of Safety Design Standards are to incorporate safety measures in a ships' designs which can eliminate casualty risks during shipbuilding processes. Excerpts of IHI's Safety Design Standards are in Appendix A.

3.4.3 Work Safety-Grade Standards

The potentials for casualties are quite different from each other depending upon the nature and location of work to be performed. Logically, safety measures should be applied proportionate to degree of risk. Therefore, work processes should be evaluated from the viewpoint of safety and controlled accordingly.

The Work Safety-Grade Standard was developed to permit classification of the risk inherent in a work process and assigning a commensurate degree of attention required by management. The standard employs four grades with "A" designating the highest risk level. For each grade an attestor is assigned in accordance with the following:

<u>Safety Grade</u>	<u>Attestor</u>
A	Shop/Section Manager
B	Foreman
C	Assistant Foreman
D	Senior Worker

Also, the process of attesting is divided as follows:

- o Pre-operation: From planning to start of work (including set-up), confirmation by the attestor is required.
- o In-process: During the progress of work, confirmation and guidance by the attestor is required.
- o Post-operation: After completion of work confirmation by the attestor is required.

Grades A and B require submittal of an application to perform the work to the General Manager prior to its start. Also, such work is registered on the Yard's Daily Operation Schedule.

Excerpts of IHI's Work Safety-Grade Standards are in Appendix B.

3.4.4 Work Process Standards

Work Process Standards are established to authorize use of only the best known work methods from safety and productivity points of view. These standards are incorporated in work manuals and cover a wide range of work processes. They range from basic and general instructions to specific instructions pertinent for each workshop.

In IHI, workers participate in developing the Work Process Standards. They are reviewed every two or three years, or any time when a problem is encountered or a better method is proposed, or in order to ensure their viability. Title of IHI's Work Process Standards are listed in Appendix C.

4.0 EXAMPLES OF S&H MANAGEMENT ACTIVITIES

4.1 Catchwords and Slogans

Catchwords and slogans are primitive but effective means to attract attention. In the '50s and '60s, safety catchwords were solicited from employees on a shipyard basis by means of a contest. At the end of each year about ten outstanding catchwords were selected and displayed in readily visible locations for the coming year. In 1969, the process was modified only to solicit catchwords on a company basis instead of by the separate shipyards and to make the selections ten days prior to the start of "Special S&H Check Month".

In 1969, 7,000 entries were received from all IHI shipyards and works. Since then the number increased to about 20,000.

4.2 Joint Safety Patrol by Management and Labor Union

Joint safety patrols of work sites by managers and union representatives are one of the most important activities in S&H management. This approach was proposed by the labor union in 1969 and was immediately adopted as a company policy.

Initially, joint safety patrols were made at the rate of once per month, but since the casualty frequency dropped significantly, the patrols were reduced to twice per year, one of which is conducted during National Safety Week. The effectiveness of the joint safety patrols is described by the following record for the four IHI shipyards:

<u>Calendar Year</u>	<u>No. of Safety Items Recorded</u>	<u>DOCR</u>
1969	964	3.18
1972	828	1.74
1975	615	0.97
1979	404	0.44
1982	284	0.73
1984		0.37

4.3 Annual Programs for Safety and Health Management

As described in Chapter 2.0, the yearly S&H management policy is determined by the Company S&H Committee. Based on this policy, more specific policies and programs are developed downstream consecutively by shipyards, departments, and sections. At the section level, yearly targets and specific implementation plans are established together with monthly-based priority items in line with shipyard priority items. Each monthly priority target is accompanied by specific procedures and check items for each classification.

4.3.1 Example of a Shipyard S&H Management Program

Appendix D contains an example of a yearly S&H Management Program Chart for a shipyard. It is accompanied by descriptions of:

- o Basic Policy,
- o Control Targets, and
- o Priority Management Policies.

Based upon the main events promoted at national and company levels, each shipyard schedules its own events, monthly priority items, campaigns, S&H programs, health diagnosis programs, etc.

4.3.2 Example of a Section S&H Program

The S&H program for a section is more specific and designates monthly-based priority safety items to be implemented and pertinent checks by job classification. An example of a S&H program for a hull erection section is given in Appendix E. The program addresses:

- o Basic Policy
- o Targets
- o Methods of Management Operation
- o Priority Safety Items Implementation Plan
- o Safety Check by Job Classification

4.4 Suggestion and Appraisal System

4.4.1 Processing and Evaluation

Employees who have ideas for improving any aspect of work are free to make suggestions to management. Special forms exist to facilitate such submittals. For a specific submittal, the group leader solicits the assistance of group members to discuss and evaluate the idea. The evaluated suggestion is then submitted to the section manager via the foreman having cognizance. The latter two, further evaluate the practical aspects of the suggestion and determine the action to be taken.

Suggestions which are distinguished enough to be considered for an award by the company's commendation system are forwarded to the section's appraisal committee. Judgments are made based upon six aspects:

- o creativeness and originality,
- o level of effort,
- o expected level of improvement,
- o applicability and practicability,
- o durability, and
- o cost return.

Each aspect may be judged to be worth up to four points. Then based upon its accumulation of points, the suggestion is graded in accordance with the following:

<u>Grade</u>	<u>Total Points</u>
A	above 21
B	17 to 20
c	13 to 16
D	8 to 12

Suggestions that are graded "A" or "B" are sent to the concerned department's appraisal committee for review and reappraisal. Those which are confirmed are then sent to the Shipyard's Appraisal Committee which is chaired by the shipyard's manager and otherwise made up of department managers. At each review, the manager representing the

proposer's activity makes sure that proposer knows how the proposal was received, how it has been handled, and whether it will be implemented. These follow-up actions are necessary to encourage everyone to continue to identify problems and propose solutions.

As Small Group Activity and Quality Circles are more-or-less synonymous, solicited suggestions are not limited to improvements in S&H. They cover all production activities including work methods, tools, jigs, etc. Sometimes a proposal for the purpose of improving safety also results in productivity improvement and vice versa.

In IHI, suggestions received per month average approximately one per person.

4.4.2 Typical Suggestions

A hull department worker observed that during inspection of gas/oxygen hoses, by immersing each hose in water, pressurizing with air, and looking for bubbles, about two meters of the hose leading to the air manifold were not immersed. The worker commented that this portion of the hose endured the most bending in service and proposed a pipe piece which would extend the air manifold outlet to beneath the water surface. All of the hose including its attachment to the end fitting could then be tested. (Improvement suggestion Grade C; appraisal points 13)

A worker in a machinery section noted that a ladder from the lower engine-room flat to the main floor below was being fitted on-board. The worker proposed fitting the top of the ladder on-block, after the block was turned right-side up, and supporting the lower (i.e., temporarily free) end with a length of wire. Thus, as soon as blocks are landed during erection, such ladders are already in place for safe transit between decks. As fitting the tops of ladders would be shifted from on-board to on-block work, productivity would also be enhanced. (Improvement suggestion Grade C; appraisal points 14))

While no monumental breakthroughs are expected, the cumulative affect of numerous bit-by-bit improvements takes on significance.

5.0 EFFECTS OF S&H MANAGEMENT ACTIVITIES

5.1 Direct and Indirect Effects

While the primary goal was to prevent casualties, IHI's S&H management activities also improved work environments and processes. For example, "blue-sky outfitting" was instituted to shift work from dangerous high, narrow, and congested spaces to relatively safe, spacious places before a hull is completely enclosed during the erection process. Combined with the concept of Group Technology, the introduction of blue-sky outfitting led to development of the Zone-Outfitting and Zone-Painting Methods. Together they comprise the safest and most productive approaches for outfitting and painting in shipbuilding. Such development experience has caused safety practices to become important and indispensable production activities.

When safety measures are integrated with production activities, as in IHI shipyards, it is practically impossible to determine the monetary savings due just to safety activity. Also, there is no analytical way to assign a value to the beneficial effects of safety measures on employee morale.

The only direct effects that could be estimated are associated with reduced medical expenses, lost time, workmens' compensation, etc. Other losses may be associated with the following:

- o An injured person may suffer more than physical damage through reduced income, perhaps some additional medical expenses, and in some very serious cases, destruction of previous life style.
- o An injured worker's shipyard, section, and/or group could experience suspension of work flows, man-hours expended by waiting, expenses to repair damages, etc.

- o An injured worker's company could incur costs associated with compensation, litigation, etc., and time and money for investigation and countermeasures. Also, socially, the company may immeasurably lose reputation by acquiring a stigma for negligence in safety management.

Thus, letting employees know about the consequences of accidents and the need for them to participate in safety management, is most important. In fact, such measures are just as important as company investments in countermeasures such as constant reviews of work processes, safety standards, facilities, and through other management activities aimed specifically at preventing casualties.

Safe working conditions and good work environments enable workers to increase productivity and product quality. There is significant positive effect on employee morale. Although immeasurable, just this latter effect is of tremendous benefit to the company.

5.2 Effects of Safety Management

In many cases accidents happen when certain conditions, any one of which would not be sufficient causation, occur at the same time. A cause can consist of two factors, an unsafe state and unsafe conduct. The first involves physical conditions, e.g., faulty facilities, poor housekeeping, and improper clothes or protective gear. The second is associated with the human element, e.g., inadequate management, insufficient education, and non-conformance with rules or standards.

Investigations disclosed that approximately 10% of the casualties experienced in IHI shipyards were due to unsafe states. Approximately 88% were caused by unsafe conduct and the remainder, about 2%, were attributed to unavoidable factors. In other words, about 98% of all casualties could have been avoided if proper measures were taken beforehand. Thus, analyzing accidents, to determine causes and applying countermeasures is very important. Especially at production sites, sources of danger should be investigated from various viewpoints in order to establish appropriate and orderly safety measures.

o Shop Arrangement

Some basic measures which contribute to both safety and productivity are:

work sites, clean, tidy and in good order,

o unobstructed passages and work spaces,

specific areas designated for material stock, scrap, and materials to be disposed,

- jigs, tools, and materials required at each work site arranged so that they are immediately available without obstructing workers, and

material flows coordinated so that interim products are completed just in time and near where they will be required next, in order to eliminate unnecessary buffer time and transportation.

Measures such as the foregoing contribute to maintaining orderly work flows, assessment of progress, detection of problems, etc. Also, they facilitate maintenance, facilities improvement, good work environments, etc. All contribute to safety.

o Improvement of Work Methods and Work Processes

Reviews of work flows, processes, and standards are necessary to constantly improve safety and efficiency. Work standards unify work methods, eliminate differences due to personal approaches, permit the application of statistical control measures, and yield more consistent levels of quality and productivity. Other basic measures for improvement are:

- perfection of initial planning so that the placement of lifting pad-eyes and scaffolding can be optimized for both safety and productivity (this contributes to increasing block sizes as well as to improving safety),

use of the Zone Outfitting and Zone Painting Methods to do as much outfitting and painting as possible in down-hand positions before erection work starts in order to improve safety, quality, and productivity (the more scientific methods caused the degree of outfitting and painting complete at keel laying to replace the degree of outfitting complete upon launching, as a yardstick for effective shipbuilding),

adopting work units, i.e., mechanized scaffolding, with stable platforms, substantial handrails, and built-in tooling to improve safety, quality, and productivity during erection work,

- constantly reviewing material handling methods to further exploit safer techniques, e.g., magnets for lifting steel plates and beams, conveyors, and one-side welding to eliminate turnover of panels,

clarifying responsibilities assigned through use of work procedures, instruction sheets, etc., when different types of work are being performed in the same space at the same time, and

improving work environments and abilities of employees to work by constant review of protection gear, jigs, tools, ventilation devices and particularly by eliminating chipping.

o Education of Workers Through Small Group Activity

- as means for countering unsafe conduct, providing safety education to workers by teaching them safety and work rules, regulations, and standards, and insuring that they put into practice what they have been taught,

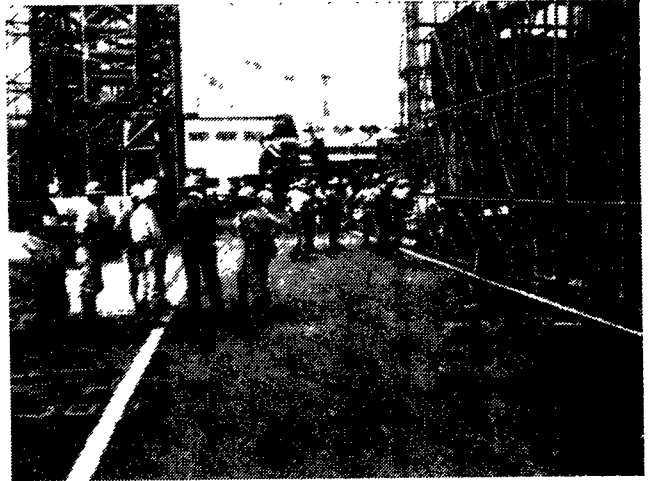
- encouraging workers to point out deficiencies in standards and let them propose improved or new standards (this gives them training in handling work problems as their problems and subsequently raises their morale),

as means to prevent casualties, letting group members take care of each other, propose work methods, and propose jigs and tools to meet their needs, and

- requiring section managers and foremen to join with their groups to analyze and solve problems so as to strengthen ties between management and workers.



A



B

FIGURE 5-1: (A) Daily activities start with gymnastics. Kinks are taken out of muscles just before the morning safety meeting. (B) Safety morning meeting by small groups in the Accomodation Section. The meeting is convened near work sites.

o Cooperation of Management and Organized Labor

Cooperation between the company management and its labor union is most essential for safety and health management as well as for improvement of quality and productivity. Success can only be achieved when human ties are solid.

5.3 Pictorial

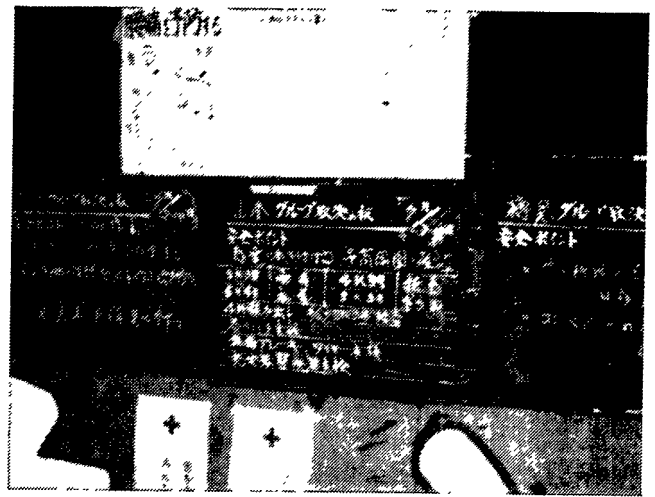
Human resources are the most valuable assets of a company and employees' morale is greatly influenced by a company's operations. S&H management brings closer ties between management and labor and nurtures a mood to work together to solve problems. When new ideas for constant improvements flourish, all involved are more secure.

Also, S&H management is more than a respect for human lives as it is also a source of vitality for company operations. In IHI, investments in S&H management have paid off handsomely. Having a viable S&H program is good business sense.

The following photographs illustrate various S&H promotional techniques which, when examined singularly, illustrate little more than what is being done in traditional shipyards. But, collectively and as a reminder of the contents of this publication, they help to convey the sense of vitality that is essential for S&H management.



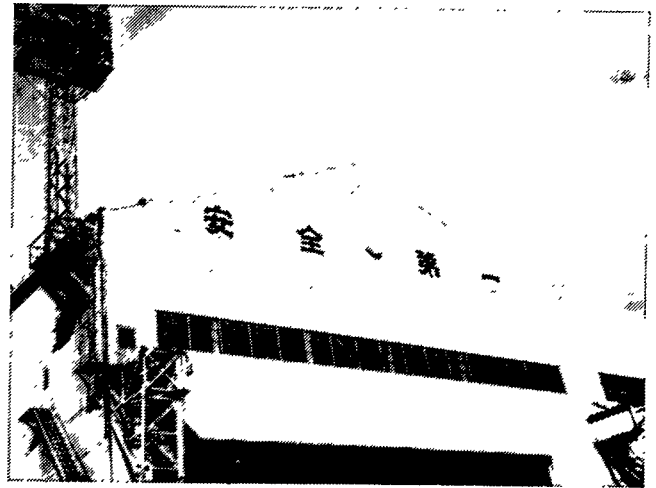
A



B



C

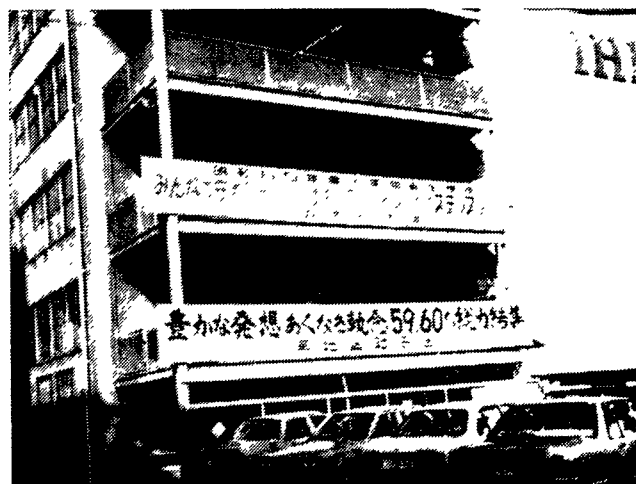


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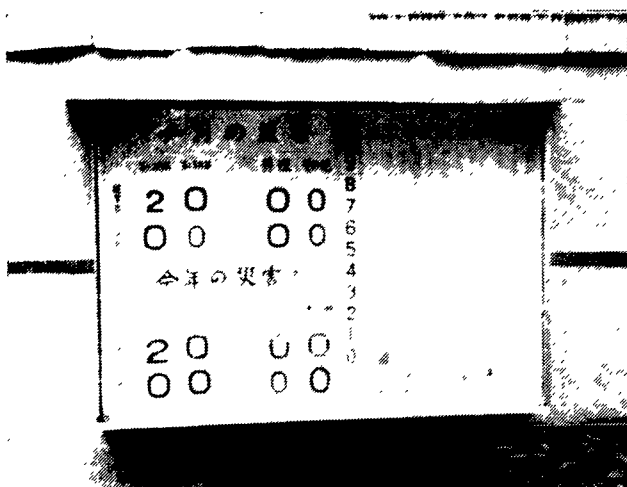
FIGURE 5-2: (A) A blackboard is used to facilitate discussion at a safety morning meeting. Meeting durations are usually five to ten minutes. (B) The blackboard used for a morning meeting is not erased as it is kept on display throughout the day near the work site. Workers can remind themselves of instructions at their own convenience. (C) Small groups regularly meet for one hour twice per month. Such meetings are approximately equally divided between matters pertaining to safety and health and matters pertaining to quality and productivity. (D) "Safety First" is written in large characters in conspicuous locations.



A



B



C



D

FIGURE 5-3: (A) The five precepts of safety are posted in frequently used passageways. 1. Safety is top priority. 2. Don't do dangerous work, don't allow dangerous work. 3. Provide advance measures to eliminate casualty causes. 4. Provide safety rules and standards. 5. Make voluntary efforts to prevent casualties. (B) Slogans are displayed at the entrances to buildings frequented by employees. A slogan adopted by a foremen's conference representing their resolution to a problem, is advertised. Other such signs display the safety catchword for the current year. (C) Safety-Results Boards are displayed in much frequented passages. Tables compare the number of accidents for the current month to the numbers logged by other shipyards. (D) The poster on the left advertises the safety subject of the month. The two large posters to the right report the results of lost-time accident investigations.

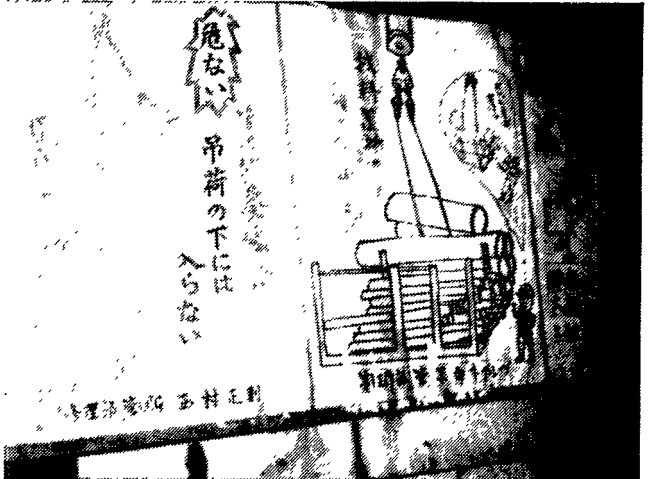
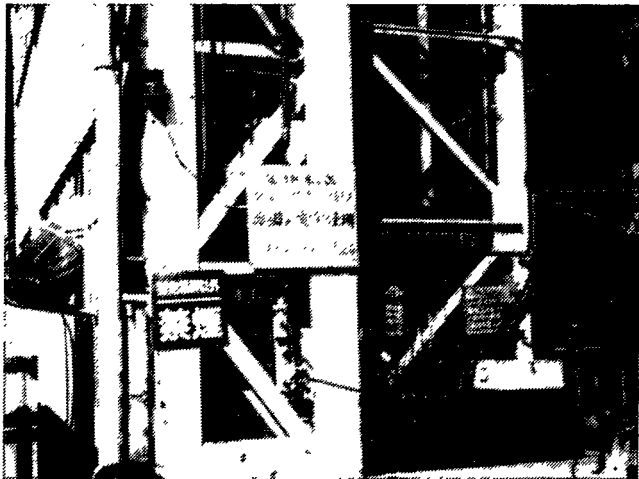
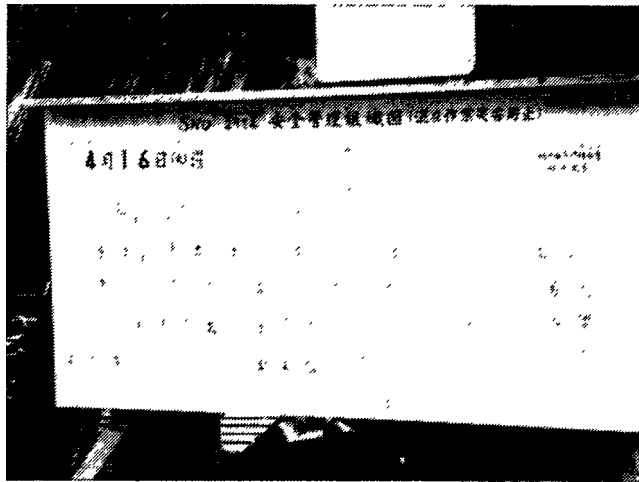
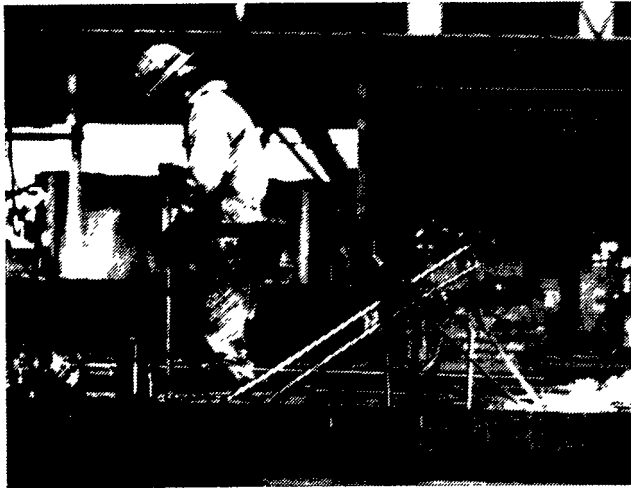
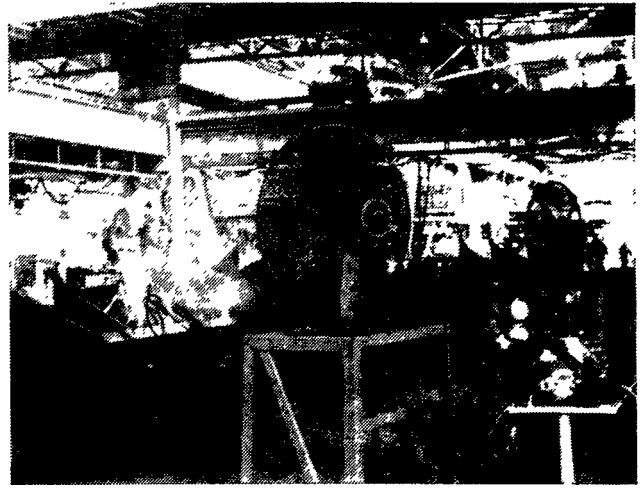


FIGURE 5-4: (A) Safety Control Organization Chart. In order to prevent accidents when different types of work must take place at the same time in the same space, a line of command is indicated per compartment. Typically, this chart is posted near the gangway used for such on-board work. (B) A display which describes hazardous places. The information conveys precautions to be taken before entering potentially dangerous compartments, e.g., containing gas, during painting, lack of oxygen, explosion prevention, etc. (C) The large sign reminds hull construction workers to connect their lifebelts to lifelines when erecting scaffolding. The sign also reminds them to check the color codes on nuts and bolts to ensure that they are the correct ones to use for erecting scaffolding. The smaller sign designates a "NO Smoking" area. (D) Examples of catch phrases that are prominently displayed. "Keep out from under loads being lifted." "Using the crane to pull slings from a load is a dangerous practice." "Avoid back injury."



A



B



C

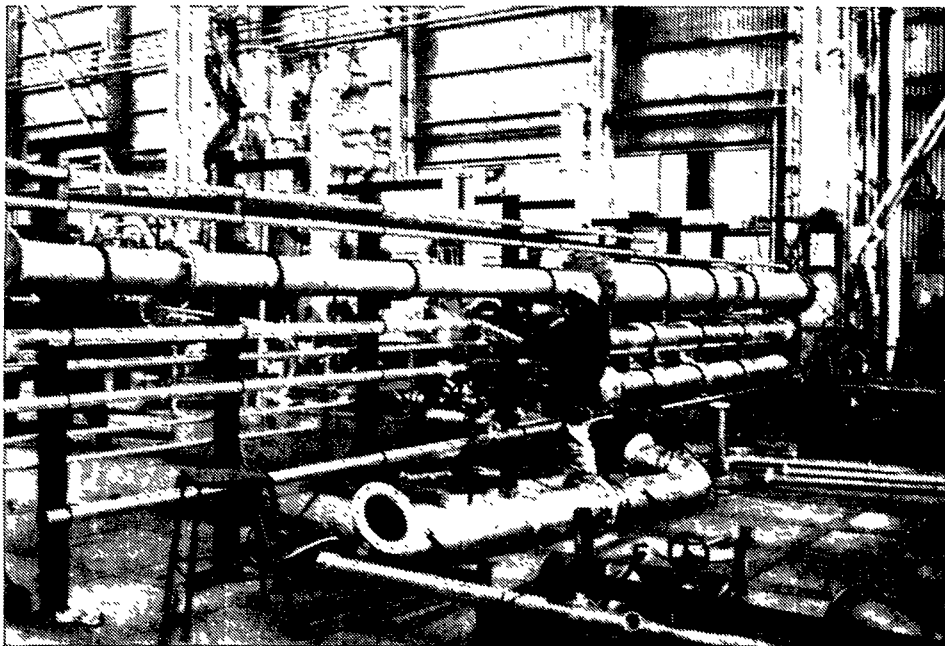


D

FIGURE 5-5: (A) Good housekeeping is important for safety. A welder in IHI's Kure Shipyard sweeps while his gravity-feed welders are operating. (B) Safety and health are both enhanced when fans are used to blow away fumes and supply fresh air during welding operations. (C) IHI shipyards employ escalators to lift workers both to enhance their safety and conserve their energy. (D) The scaffolding shown enhances safety. The vertical sections are modularized so that the scaffolding may be erected for various heights. The upper sections are adjustable within a range of angles to accommodate different ship designs and for use against ships' bows or sterns.

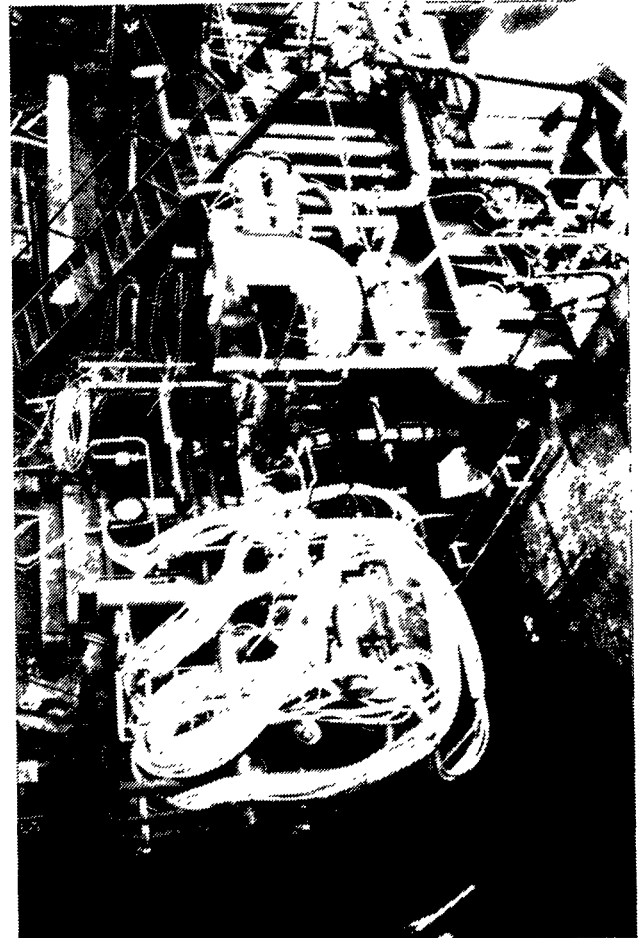
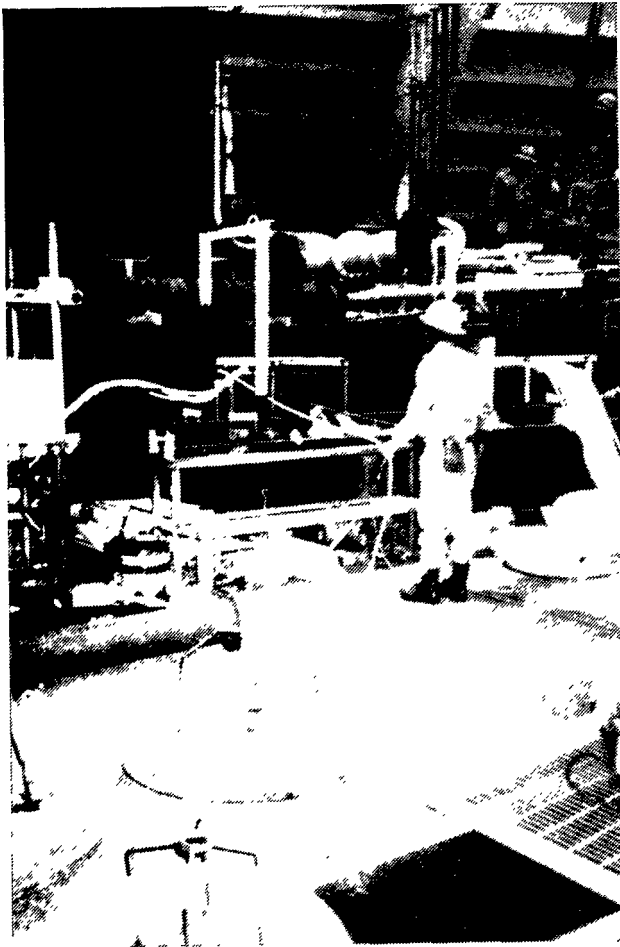


A



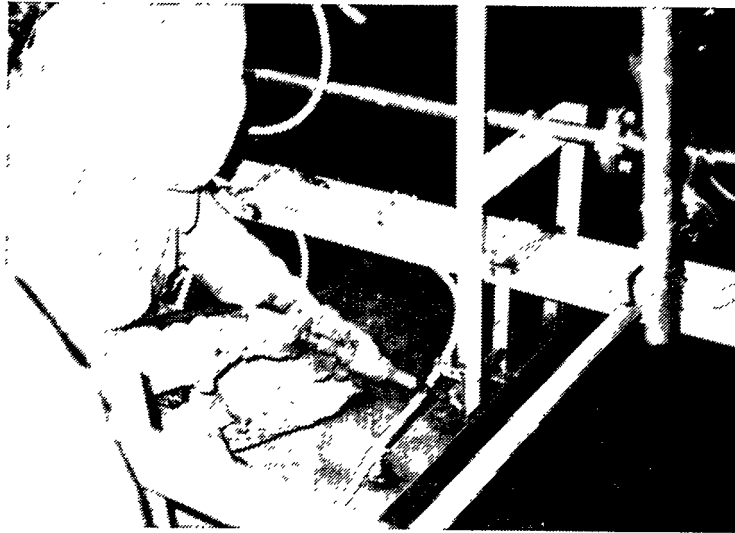
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FIGURE 5-6: (A & B) Outfitting on-unit per the Zone Outfitting Method greatly enhances both safety and productivity. Workers assigned to assembly sections wear leggings and safety belts at all times even when working indoors as some climbing may be required. A 3-meter lifeline is carried in a small canvas bag attached to each lifebelt. In order to be sure that unsafe clothing is not worn, IHI provides work uniforms including safety shoes. Each shoe is supplemented with a steel spat to protect the instep.

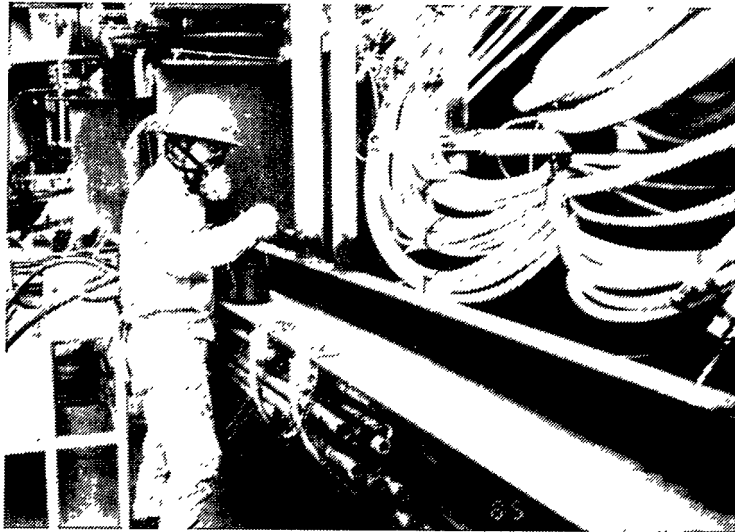


B

FIGURE 5-7: (A & B) Outfitting on-block per the Zone Outfitting Method greatly enhances both safety and productivity. Work is greatly facilitated when ceilings are positioned upside down during outfitting. Both safety and productivity are particularly enhanced when as much as possible, electric cable is pulled on-block. At the particular stage when cable pulling takes place, each precut cable length is regarded as a fitting equivalent to a pipe piece. In IHI nearly 70% of cable for accommodation spaces and about 40% of machinery space cable is so pulled on-block without use of electric-cable splices.



A



B



C

FIGURE 5-8: Per the Zone Painting Method, cleaning of welds (A), paint touch up (B), and applying finish undercoat (C), are performed more safely and productively when ceilings remain upside down following cable pulling.

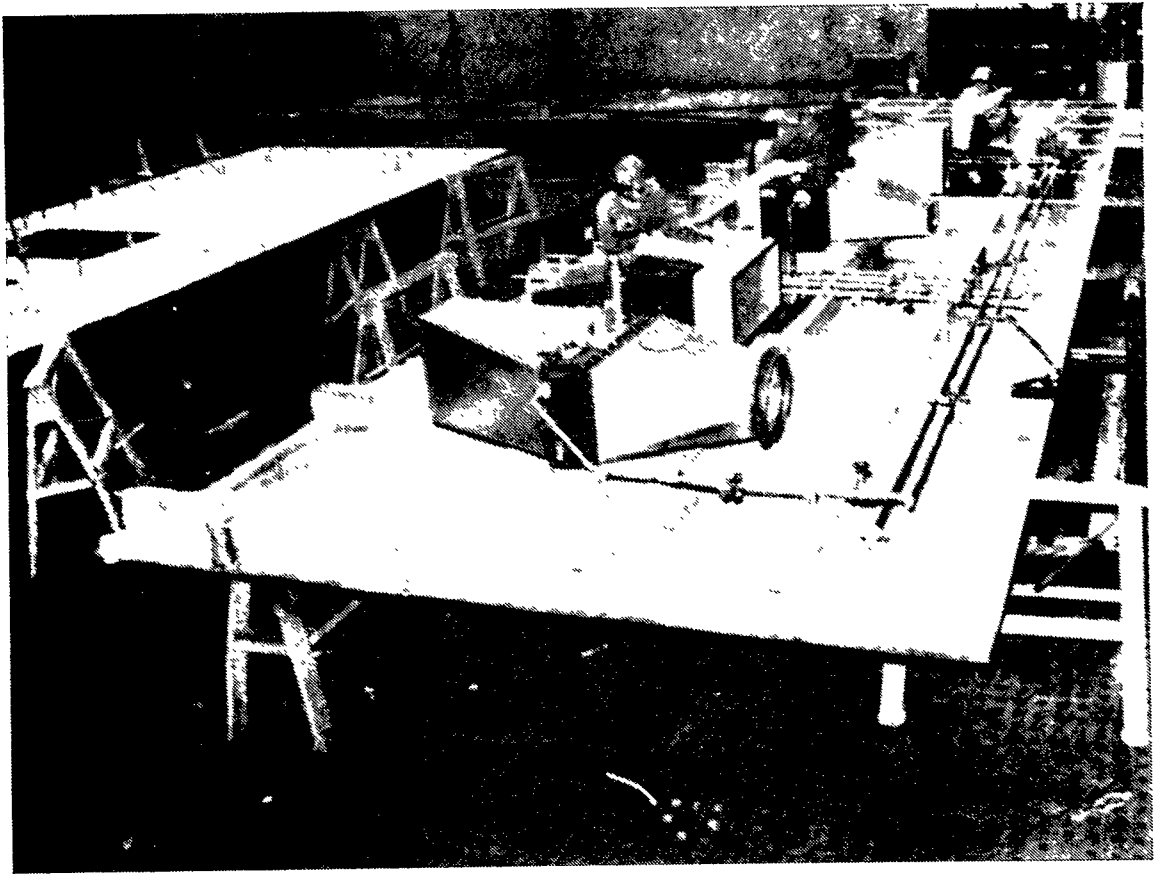


FIGURE 5-9: The Zone Outfitting Method enables people in Puget Sound Naval Shipyard to work safer, easier, and more productively. Ship alteration work formerly performed on-board with people having to work with their arms over their heads, is now accomplished down hand on-block. Per a build strategy conceived at the outset through design/production interaction, designers "layered" fittings associated with different types of work. That is, their design anticipated that different types of work will be performed stage by stage so that work teams do not compete with each other for access to work. As shown on the block to the left, all of the supports regardless of system, i.e., for pipe and vent-duct systems, wireways, etc., were welded in place down hand per a single work instruction in the form of a CAD produced zone/stage (layer) composite drawing. Similarly, the stage in progress on the block shown in the foreground, is reserved for fitting all piping regardless of the systems represented. Per W. Edwards Deming, "people work smarter not harder" and safety, quality, and productivity are greatly improved. Welders, because they endure hot metal dropping when welding over their heads, are particularly strong advocates of the Zone Outfitting Method.

No.	Safety Design Item	Objective
1.	<u>Holes through centerline swash bulkheads</u> Access holes must be located near block joints.	To secure better accessibility and to prevent workers from falling.
2.	When structural members such as webs and panting stringers (horizontal members) are used as passage, they must be 500mm or more in width.	To Prevent workers from falling.
3.	The upper end of the bow construction must be assembled into a three-dimensional block, with the bulwarks joined together.	To reduce work at high places, and to prevent articles and workers from falling.
4.	Block seams must be located above horizontal members such as flats, webs and painting stringers in order to reduce scaffolding.	To secure better working conditions, and to prevent workers from falling.
5.	Access holes and lightening holes must be minimized in passage areas. Guard bars must be fitted around the hole if these holes must be cut.	To Prevent workers from falling.
6.	In arranging the upper block of bow construction, its center of gravity must be taken into consideration to prevent heeling during its erection.	To prevent workers and articles from slipping.
7.	Block arrangement must be made so that the bellmouths could be fitted during assembly. Bellmouths must not be placed on block joints.	To prevent from dropping, and to facilitate transportation.
8.	In principle, walls and pillars, fitted under decks, flats, etc., must be fitted during assembly. When the block is likely to heel after it is overturned for erection, temporary stays must be provided.	To prevent workers from falling, and to prevent slipping.
9.	<u>Temporary holes for construction</u> Temporary holes for construction in the forepeak tank must be arranged in a straight vertical line so that the scaffolding can be removed easily.	To facilitate transportation.

No.	Safety Design Item	Objective
10.	Structures must be designed to allow net clearance of 400mm or more between faces of longitudinal arranged opposite to each other.	To secure more space for working in narrow spaces, and to prevent workers from electric shocks.
11.	In narrow spaces, groove faces of butt weld must be placed at the spacious side.	To secure more space for working in narrow spaces, and to prevent workers from electric shocks.
12.	When web plates cannot be fitted to skin plates at right angles, such as on curved shells, collar plates must be fitted on the obtuse side, in principle, where longitudinal penetrate the web plates.	To allow space for welding.

B. Cargo Oil Tank Construction

No.	Safety Design Item	Objective
1.	Permanent access holes must be arranged through bottom and upper transverse webs.	To allow better accessibility.
2.	<u>Temporary holes for construction through longitudinal bulkheads</u> Access holes must be arranged near block butt joints to secure easy passage between the center tank and wing tanks.	
3.	The lower edge of the holes through swash bulkheads must be positioned 900mm or more above the horizontal girders when the girders are fitted only on one side of the bulkhead.	To prevent workers from dropping.
4.	Access holes must be cut through horizontal girders or transverse webs on side shells, bulkheads, etc., to secure easy accessibility during assembly.	To allow better accessibility.
5.	In case of a special shaped block, its erecting direction must be shown by marking -on drawing.	To prevent workers from falling.
6.	In case of insertion blocks, the joints of its frames must be shifted from the plate butt line to allow support by adjacent blocks.	To prevent the block from falling or dropping through the gap between adjacent blocks.

No.	Safety Design Item	Objective
7.	Round gunwale plate must have enough flat edges from the curvature ends to prevent slipping during its assembly.	To prevent slipping during assembly.

C. Pump Room Construction

No.	Safety Design Item	Objective
1.	Coaming plates must be fitted around openings through flats in the pump room to prevent articles dropping through the holes.	To prevent article dropping through holes.
2.	Access holes through the bottom shell plate and the inner bottom of the double bottom should be equal in size, and arranged in a straight vertical line. The hole at one side of the double bottom is to be used for passage and the one at the opposite side is to be used for installation of the ventilation fan.	To allow better accessibility and ventilation.
3.	Double bottom must be at least 1000mm in height to allow sufficient space to work. If the height of 1000mm or more cannot be taken, at least one watertight manhole or a temporary hole for construction must be arranged for each compartment.	To allow better working conditions and to prevent workers from electric shocks.

D. Engine Room Construction

No.	Safety Design Item	Objective
1.	<p><u>Temporary holes for construction in the engine room</u></p> <p>Access holes must be arranged at both sides of the side shell of the engine room to allow easy access for the workers, and bringing in fittings and tools from the ground to the engine room flats.</p> <p>The position of temporary holes must be determined taking the following into consideration:</p> <p>a) The holes must be positioned to allow easy access, through the engine room. Position should be discussed</p>	To allow better accessibility.

No.	Safety Design Item	Objective
	<p>between the Hull Construction and Engine Outfitting design sections, based on Machinery Arrangement Plan.</p> <p>b) The holes must be at least 2m wide and 2m high. Block seams and butt joints should be fully utilized in arranging the holes.</p>	
2.	When gratings are arranged above the engine flat, access holes should be arranged above the grating level as far as possible.	To allow better accessibility.
3.	<p><u>Access holes arrangement</u></p> <p>Access holes must be arranged where many works must be done or where the passage is interrupted by walls, girders, etc. The holes must be equal in size and, as far as possible, arranged longitudinally in a straight line.</p>	To allow better accessibility and working condition.
4.	<p><u>Relation between hull structures and fittings</u></p> <p>Careful discussions must be made between all design sections to prevent obstacles such as passage interruption caused by pipes passing through accessholes, and/or welding obstructions caused by heating coils laid close to hull structural members.</p>	To allow better accessibility and secure better working conditions.
5.	Two watertight or oiltight manholes must be arranged diagonally on top of a tank compartment. Temporary holes must be cut for gas exhaust and ventilation, as required.	To allow better accessibility and secure better working conditions.
6.	Block joints should be avoided, as far as possible, in sea chests and wells.	To secure better working conditions in narrow spaces.
7.	In case of an independent tank, the tank bottom must be at least 500mm above the deck and the tank top should have at least 700mm overhead clearance. The clearance between any bulkhead and the tank wall must be at least 600mm.	To secure better working conditions in narrow spaces, and to prevent workers from electric shocks.
8.	Reinforcing rings around openings should be avoided in every possible way in narrow spaces to make human passage easier.	To allow better accessibility.
9.	Steps for scaffolding must be fitted on floor plates of excessive height in engine room double bottom.	To secure better working conditions.

E. Stern Construction

No.	Safety Design Item	Objective
1.	Openings in center line swash bulkheads, girder, floors, etc. a) Access holes must be arranged near block joints. b) Access holes must be arranged with due consideration on accessibility in both assembly and erection stages.	To allow better accessibility and to prevent workers from falling.
2.	<u>Temporary holes for construction</u> Temporary holes for construction in the aftpeak tank must be arranged in a straight vertical line to facilitate removal of scaffolds.	To facilitate transportation.
3.	Lightening holes should be avoided as far as possible within passage areas. Carefull attention must be paid in arrangement. For example, a hole through a floor and a hole through a flat should be mutually shifted to avoid falling through two or more holes.	To prevent workers from falling.
4.	<u>Temporary holes to install a rudder tillar, rudder carrier, etc</u> Holes should be arranged to facilitate smooth passage of articles without excessive inclination.	To facilitate transportation.
5.	<u>Shape and arrangement of access holes</u> a) In principle, access holes must be eliptical. b) When the hole cannot be shaped eliptical due to strength, it must be round and at least 400mm in diameter, or it must be reinforced if eliptical shape is to be maintained.	To allow better accessibility.

F. Auxiliary Machinery Flats

No.	Safety Design Item	Objective
1.	In principle, auxiliary machinery foundations must be fitted on assembled blocks excepting those that are fitted on decks, flats, and tank tops which could be placed later.	To prevent worker and articles from falling or droppi down.
2.	Foundations must be arranged to utilize hull framing members in every possible way, so that reinforcement under deck can be minimized.	To prevent dropping of carling members.

No.	Safety Design Item	Objective
3.	No webs of auxiliary seats should protrude in crowded areas as the protruding members may injure the workers.	To secure safety and better accessibility.
4.	If the auxiliary seats have to be placed in narrow spaces, the web plates must be arranged considering clearance between neighboring structures, so that the fastening of machinery foundation bolts can be fixed easily.	To secure better working conditions in narrow spaces.
5.	Large machinery seats such as those for winches and windlass must be fitted with four hoisting eye plates.	To facilitate transportation.

G. Superstructures and Deck Houses

No.	Safety Design Item	Objective
1.	Large house assembly blocks for living quarters must be planned with due consideration on shapes, weight, (house, fittings, lifting tools etc., included) and gravity centers, etc., through discussion with all shops concerned.	To allow easier handling and to facilitate transportation.
2.	Weight of large three dimensional blocks must be checked and decided, including the weight of the fittings installed.	To ensure safe transportation.
3.	In case of a three-dimensional block, careful attention must be paid regarding the position of its center of gravity, the position of its lifting pieces, surrounding circumstances, and its inclination when lifted, etc.	To ensure safety.
4.	Temporary holes for construction must be arranged where there are no fittings so that danger in passing, delay of fitting work and difficulty in restoration could be avoided.	To allow better accessibility.
5.	Deflection should be avoided by means of strain relieving pieces and carlings to reduce flame burning work.	To improve working conditions.
6.	<u>Funnel lifting procedure</u> Funnel lifting rings must be fitted on the inner side of the outer funnel to eliminate scaffolding work. In principle funnel must be completely painted before it is supplied to the yard.	To eliminate work at high places.

H. Hull Structure, General

No.	Safety Design Item	Objective
1.	<p>Hull Structure in the Yard:</p> <p>Hull blocks must be designed not to exceed the capacity limit of the yard facilities.</p> <p>Weight limit at each stage</p> <p>The actual lifting weight of a structural member or a block must not exceed 90% of the lifting capacity of the crane.</p> <p>The block weight should include, not only the weight of hull structure, but also the weight of various outfitting, such as auxiliary machinery and pipes, etc., that are fitted on the block. So when dividing the hull structure into blocks, each block weight must be checked considering the additional outfitting weight.</p>	To ensure safe transportation
2.	<p><u>Weight of Loose and Temporary Attachments</u></p> <p>Some members must be installed or fitted on board as loose or temporary attachments due to erection sequences and structural condition. The weight of the attachment pieces should be decided, in every possible way, in accordance with the following criteria:</p> <p>a) At Low Places:</p> <p>When the pieces can be handled at low places such as on decks, flats and horizontal girders, where stable working conditions can be maintained and easy transportation and positioning can be made:</p> <p>(1) In case a small number of pieces are used: 200kg or less per piece</p> <p>(2) In case a large number of pieces are used: 100kg or less per peice</p> <p>b) At High or Narrow Places:</p> <p>Where handling or positioning is difficult, such as on high scaffoldings, and/or handling and transport is difficult, such as in narrow spaces: 40kg or less per piece</p> <p>The temporary attachments must be checked considering where the pieces will be attached, and attached in accordance with the instruction on the drawings.</p>	To ensure safe transportation

kNo.	Safety Design Item	Objective
	It must be attached at safe spots where neither fittings nor scaffolding are attached.	
3.	The number of holes must be kept to minimum when arranged on horizontal members such as nontight flats, horizontal girders, panting stringers, etc., and the vertical distance between each of the members are 2.0m or higher. Guard bars must be fitted when the hole diameter exceeds 150mm.	To prevent workers from falling through
4.	Structure and block arrangement must be designed in every possible way to avoid temporary reinforcement to erect or overturn the blocks.	To prevent redundant weight
5.	Structure and block arrangement must be designed in every possible way so that it can be installed without temporary stays during erection.	To prevent blocks from tumbling
6.	Structure must be designed in every possible way to eliminate members which intersect any block joint, so that the number of the temporary attachments can be reduced. Especially, no temporary attachment should be fitted in narrow spaces.	To prevent dropping of pieces when removed
7.	All reinforcement under fittings and auxiliary machinery foundations must be shown in the hull structure drawings so that it can be finished, in principle, during assembly.	To prevent dropping of pieces during fitting
8.	<u>Access Holes</u> Access holes must be arranged considering access, ventilation, scrap disposal, removal of scaffolding, etc. The number of access holes must be kept to minimum. The access holes must be carefully arranged through discussion: between hull, outfitting and painting departments. No access holes should be arranged on spots where ladders are fitted.	To allow each accessibility, and Provide efficient working conditions

I. Outfitting, General

No.	Safety Design Item	Objective
1.	In principle, outfitting should be carried out on blocks on the ground level where excellent and safe work can be executed. Therefore, block outfitting drawings must be timely released to keep pace with work in progress. Discussions between pertinent shops and sections are essential to perfectly achieve the above.	To increase outfitting works on ground level
2.	Careful attention should be paid to identify whether any new design or new system or particularly unconventional design is adopted.	To prevent unexpected accidents
3.	Confirm whether any safety devices (limit switches, stoppers, etc.) is required. If required, confirm whether it is designed to actuate effectively.	To understand the characteristics of new equipment and the way to check them safely
4.	Trial runs for new equipment must be made with the presence of expert design engineers.	To prevent accidents caused by new equipment
5.	Equipment must be arranged to enable safe operation, maintenance, and inspection.	To enable safe maintenance
6.	Especially when a new equipment is used, it must be checked whether accidents could be caused by misoperation or by poor design, and/or whether dual safety devices can be employed to prevent any accidents resulting from mistakes.	To prevent accidents caused by new equipment
7.	Installation of machinery or equipment in narrow spaces should be avoided as far as possible, unless required by regulatory or functional requirements.	To secure better working condition
8.	Fitting sequences of machinery or equipment must be indicated when installed in narrow spaces. When it is difficult to install them, in spite of all efforts, temporary holes should be provided for the convenience of installation, conferring with the hull design section beforehand.	To secure better working condition in narrow spaces
9.	Equipment installed in narrow spaces should be assembled into units, if effective.	To secure better working condition in narrow spaces

No.	Safety Design Item	Objective
10.	<p>Eye plates should be fitted to heavy equipment in the following way:</p> <ul style="list-style-type: none"> a) Two or more eye plates should be used, if possible. b) Total lifting weight capacity of the eye plates must be at least one and a half times the weight of the equipment to be lifted. c) Lifting weight must be distributed evenly on each eye plate. Three eye plates should be used, if possible. d) Sufficient reinforcement is required where eye plates are fitted. e) The welding procedure of the eye plates must be shown on the drawings. 	To prevent accident during transportation
11.	<p>Heavy machinery or equipment should be placed on frame members. If this is impossible, the hull design section must add carlings as required. Arrangement of the equipment must be checked with the hull design section. Otherwise, some carlings will have to be fitted on board.</p>	To secure strength
12.	Adjusting or cutting on board should be minimized.	To do the work safely and easier
13.	Sheer and camber must be shown on the drawings so that the bottom of the seats could be cut off to fit.	To make the work easier
14.	To prevent fire and accidents, installation of equipment requiring welding must be completely welded before any combustible material is installed.	To prevent fires and to establish stage-by-stage preparation
15.	<p>Incombustible heat insulating materials and adhesives must be selected in every possible way. Fire resistant materials should be used at the least.</p> <p><u>Note:</u> Processing of urethane foam onboard should be avoided in every possible way.</p>	To prevent fire
16.	Materials that may generate toxic gas by fire should be avoided in every possible way. However, if they are used, they should be used only in spaces where sufficient ventilation is available. Materials which have possibility of generating toxic gas should be known to all sections and shops concerned.	To prevent fire

No.	Safety Design Item	Objective
17.	Galvanizing of equipment should be avoided in every possible way except those used in exposed areas to reduce toxic gas generation caused by welding.	To prevent gas toxication
18.	Careful attention must be paid to avoid dangerous works, such as to fit or remove equipment from outside the ship.	To prevent workers from falling
19.	Equipment that must be installed at high places should be as small and as light as possible.	To reduce weight for easier handling
20.	Protection covers must be fitted on dangerous machinery, such as rotating shafts, that may hurt persons.	To prevent human injuries
21.	No machine should be arranged in such a way that requires the operator to control the machine with his back against another moving machine.	To prevent human injuries
22.	When any new electric instrument bought in the market is used, it should be discussed with the electric design section to include necessary instruction, to prevent electric shocks and leaks, in the drawings.	To prevent workers from electric shock
23.	Stairs and ladders in the accommodation space and vertical ladders must be completely fixed. No temporary ladders should be used during outfitting work.	To prevent workers from falling
24.	Ventilators and ventilation ducts must be installed after ladders, steps and hand holds are fitted.	To secure safe fitting work onboard
25.	Manufacturers must be mandated to indicate the weight on their product before its delivery to the yard.	To prevent accidents during transportation
26.	Any welding, required to install an equipment in a compartment next to a fuel tank, must be perfectly welded before fuel is loaded. If any rework is needed later, it must be done after confirming that no oil is in the fuel tank.	To prevent fire
27.	As the dimensions of seats for some statutory lights are fixed by law, attention should be paid during design.	To prevent reworks

No.	Safety Design Item	Objective
28.	Fittings (wall ventilators, lighting seats, etc.) which are fitted on the exterior side of the superstructure and deck houses should be fitted on the ground.	To execute works on the ground
29.	Oxygen and acetylene bottles must be stored in exposed areas and covered to avoid heating by the sun.	To prevent explosions

Division			Type of Operation	Grade	Attester			Remarks
L	M	S	Contents of Work		Pre	In	Post	
A	a	1	<u>Machinery</u>					
			<u>Vehicle Transportation</u>					
			When transporting tall sub-blocks that are liable to topple	C	C	C	-	Check lashing state
	b	1	<u>Slinging Operation</u>					
			Reversing of structural sub-blocks: 1st block	B	B	B	B	Check first block only
		2	2nd and succeeding blocks	C	C	C	C	
B	a	1	<u>Major Assembly</u>					
			<u>Slinging Operation</u>					
			When reversing complicated cubic blocks	B	B	B	B	
		2	When loading a irregular shaped block on a carriage trailer	B	B	B	B	Check whether loading is secured
		3	When stacking block on blocks for more than three tiers	C	C	C	C	
		4	When stacking blocks for more than three tiers, check the state of the bottom level where it is placed	B	B	B	C	
		5	Reversing operation by double slings from a floating crane	A	A	A	B	Check floating condition of the crane barge
		6	Receiving by double slings from floating crane	C	C	C	C	
	b	1	<u>Erection Operation</u>					
			Arrangement of bent shell plating and other structural members, liable to slip or topple	B	B	B	B	At the instant when the sling wire is removed
C	a	1	<u>Erection Operation</u>					
			<u>Block Receiving Operation</u>					
			When receiving an extra-large cubic from a floating crane	A	A	A	A	Prepare for receiving, check at the instant the sling wires are removed

L - large
M - medium
S - small

Pre - pre operation
In - in process
Post - post operation

Division			Type of Operation	Attester			Remarks
L	M	S	Contents of Work	Pre	In	Post	
	b	2	Block mounting when majority of the block weight is received by supports and locked by guy wires	A	A	A	Check the instant the crane is released
		3	Block mounting when the majority of the toppling moment is received by supports	B	B	C	
		5	Mounting a cubic block with bottom area less than the top area	B	B	B	Check the instant the crane is released
		7	Determination of crane slings for mounting a block	B		B	
			<u>Miscellaneous</u>				
		1	Water filling leak test	C	C	C	Check manholes, etc. before filling
			<u>Welding and Gas Cutting Operation</u>				
		1	Gas cutting and welding unconfined spaces, where body movement is quite difficult	C	C	C	Check instructions before starting the work
		2	When welding in the vicinity of a tank filled with oil	B	B	B	
		3	When carrying it out on a suspended platform	C	C		Pre-work check only
	d	5	When fire is used in a compartment where the lining has been completed	B	B	C	
		7	When welding/gas cutting in a tank which hydraulic test has been completed	C	C	C	
			<u>Scaffolding</u>				
		1	Assembly/diassembly of special scaffolding not shown in standards	B	B	B	
		2	Assembly/diassembly of scaffolding under navigation bridge wings	C	C	C	
		3	Assembly/diassembly of scaffolding on side shell when the ship is afloat	B	B	B	For pulling out rudder or removing propeller
		4	Disassembly of scaffolds of 10 meters or over	B	B	C	

Division			Type of Operation	Grade	Attester			Remarks
L	M	S	Contents of Work		Pre	In	Post	
		5	Assembly of scaffolds of 10m or over	B	B	B	B	
		6	Disassembly of scaffolds of 5-10m	C	C	C	C	
		7	Assembly of scaffolds of 5-10m	C	C	C	C	
		9	Assembly/disassembly of rolling tower of four stages or over (height over 7m)	C	C	C	C	Provide measures to prevent toppling
D	a		<u>Operation of Cranes, new machinery & Equipment</u>					Witness during lifting and moving
			<u>Crane Operation (including Overhead Cranes)</u>					
		1	When loads equal to 95% of the crane capacity are lifted: For jib cranes For overhead cranes	B C	B C	B C	— —	
		4	Double slinging with cranes of same capacity; Loads of 80-90% of total capacity	B	B	B	—	
		5	Ditto.: 80% or less of total capacity	C	C	C	—	
		6	Double slinging with cranes of different capacities; Loads of 70-80% of total capacity	B	B	B	—	
		7	Ditto.: 70% or less of total capacity, but exceeding the capacity of the larger crane	C	C	C	—	
		8	Multi-crane slinging by 3 cranes or more	A	A	A	—	
		10	Crane relocation	A	A	A	A	
		11	Releasing the outreach limit of the Level-Luffing-Crane (LLC)	B	B	C	C	
	b		<u>Machinery/Equipment of New Models or Types</u>					
		1	Trial of new models	A	A	A	A	
		2	Repair of machinery installed permanently	B	B	C	C	Check function and operation

Division			Type of Operation	Grade	Attester			Remarks
L	M	s	Contents of Work		Pre	In	Post	
E	a		<u>Major Outfitting Operation</u>					
		1	Main engine mounted onboard in one complete set	A	B	A	B	Turbine or diesel
		2	Deckhouse structure mounted onboard in one piece	A	A	A	B	
		3	Trial of new machinery and equipment of new model or type	A	A	A	c	
		4	Main engine initial start	A	A	A	c	
		5	High pressure steam initial pass, with safety valve sealed	A	A	B	B	20kg/cm ² or above
		6	Pre-launching checks (including shifts, floating, undocking)	A	A	c	c	
		12	CO2 release test	A	A	A	c	
		13	Inert gas test	A	A	A	c	
		14	Open-up operation of steam auxiliaries with boiler alive (10 kg/cm ² or over)	A	A	A	C	
		15	Welding adjacent to tanks filled with oil	A	A	A	c	
		16	Conversion/rework inside tanks after fuel oil or lube oil is loaded	A	A	A	c	
	b		<u>Secondary Outfitting Operation</u>					
		1	Loading units of over 30 tons to barge	B	B	B	c	
		2	Mounting, installation using outfitting by outfitting crane	B	B	B	B	
		3	Double slinging with two cranes of same capacity: Loads of 80-90% of total capacity	B	B	B	c	
		4	Ditto. with different capacities: Loads of 70-80% of rated load	B	B	B	c	
		5	Relocation of machinery & equipment	B	c	B	c	Hoists, small cranes, etc
		6	Welding in the vicinity of tanks filled with oil	B	B	B	B	Vicinity means 100-500mm from the tank

Division			Type of Operation	Grade	Attester			Remarks
L	M	S	Contents of Work		Pre	In	Post	
		8	Pre- and post-checking when welding inside a tank which had been loaded with inflammable liquid	B	B	B	C	
		10	Use of fire in engine room, casing wall and other places adjacent to inflammable materials (incl/opposite side)	B	B	C	C	
		11	Use of fire in locations inside a paint-tank where gas exists	B	B	C	C	
		12	Check and confirmation of safety before commencing work in confined spaces	B	B	C	C	
		13	When entering into a compartment which may lack oxygen	B	B	--	--	
		14	Maintenance of local gas, oxygen and air piping	B	B	C	C	
		15	Loading, installation, removal and landing of outfitting elevator	B	B	B	B	
F	a		<u>Operations Classified by Compartment-by-Compartment</u>					
			<u>Deck Outfitting</u>					
		1	Mounting of pump room upper unit	B	B	B	C	
		2	Anchor chain loading	B	B	B	C	
		4	Mounting, installation of derrick posts and masts	B	B	B	B	
		5	Mounting of large outfit units, each of over 30 tons	B	B	B	C	
		7	Loading of blocks, pre-outfitted on-board	B	C	B	C	
		8	Loading and installation by gantry crane	B	B	B	C	
		9	Conversion of hydraulic or fuel oil lines after oil has been passed	B	B	B	C	
		10	Tank cleaning during ballasting or de-ballasting	B	B	C	C	

Division			Type of Operation	Grade	Attester			Remarks
L	M	s	Contents of Work		Pre	In	Post	
	b	12	Shipboard crane cargo loading unloading test		B	B	c	
		13	Initial steam passing trial		B	c	c	
		14	Hatch cover operation test		B	B	c	
		15	Accommodation ladder test		B	c	c	
		16	Anchor test		B	c	c	
		17	Shipboard high pressure pipes hydrostatic test (60kg/cm ² or over)	B	B	B	C	
		18	CO ₂ fire fighting equipment final installation check	B	c	B	B	
		24	Container test	B	B	B	c	
		25	Check of stopper lock after CO ₂ fire fighting release wire is set	B	B	c	c	
			<u>Accommodation Outfitting</u>					
		1	Mounting and installation of radar post	B	B	c	c	
		2	Mounting, landing, installation of outfitting elevator	B	c	B	c	
		4	Loading of block after pre-outfitting onboard	B	c	B	c	
		5	Mounting of navigation bridge wing	B	c	B	B	
		6	Mounting of trolley crane	B	B	B	c	
		7	Mounting of deck house, casing	B	B	B	c	
		8	loading and installation of gantry crane	B	B	B	c	
		9	Life boat hoisting/launching test	B	B	B	B	
		10	Shipboard crane loading/unloading test	B	B	B	c	
		11	CO ₂ fire fighting equipment final installation check	B	c	B	B	
		12	Shipboard elevator preparation check	B	c	B	C	

Division			Type of Operation	Grade	Attester			Remarks
L	M	S	Contents of Work		Pre	In	Post	
-	c	15	Boat davit installation	C	C	C	C	
		16	Life boat installation	C	C	C	C	
		19	Use of fire after joiner linings are installed	C	C	C	D	
		20	Operation on radar post	C	C	C	C	
			<u>Machinery Outfitting</u>					
		3	Mounting of units over 30 tons	B	B	B	C	
		5	Installation of main turbine machinery	B	B	B	C	
		6	Installation of propeller	B	C	B	C	
		7	Installation of propeller shaft	B	B	B	C	
		8	Installation of intermediate shaft	B	B	B	C	
		9	Installation and assembly of main diesel engine	B	B	B	C	
		10	Installation of main condenser	B	B	B	C	
		11	Installation of reduction gear	B	B	B	C	
		12	Installation of main boiler	B	B	N	C	
		13	Installation of large air heater	B	B	B	C	
		14	Expansion /press fit of rudder coupling bolts	B	B	B	C	
		15	Installation of rudder stock and rudder plate	B	B	B	C	
		16	Expansion fit of tail shaft bearing bush	B	B	B	B	
		17	Conversion of hydraulic pipe or fuel pipe after oil has been passed	B	B	B	C	
		18	Blowing of high pressure air pipe	B	B	B	C	
		19	Initial passing of steam	B	B	C	C	
		20	Boiler ignition	B	B	B	C	

Division			Type of Operation	Grade	Attester			Remarks
L	M	s	Contents of Work		?r~	In	Post	
d		21	Shipboard hydrostatic inspection of High pressure lines of 60 kg/cm ² or over	B	B	B	c	
		24	Check and witness of steam blow of steam lines	B	B	B	c	
		25	Open up of main turbine	B	B	B	B	
		26	Loading of fuel oil and lube oil	B	B	B	B	Do not start loading at night time
		38	Open up of boiler auxiliaries within 48 hours after boiler shut down	B	B	-	-	
		39	after rust prevention treatment applied	B	c	B	C	
		42				C	C	
		44	Installation of steering gear unit	c	c	c	C	
		52	Assembly/disassembly of scaffolds in engine roan	c	c	D	c	Openings, upper deck head casing, etc.
		54	Installation/removal of rudder and propeller units	c	c	c	c	
			<u>Electric Outfitting</u>					
		1	Tests of high voltageelectrical equip-600 KW and above	B	B	c	c	
		2	Adjustment of main engine remote control	B	c	B	c	
		3	Cenerator test	B	B	B	c	
		4	Shore power input to main switchboard	B	B	B	C	
		5	Initial transmission of temporary ship board power supply	B	B	B	c	
		6	Cleaning and tightening of terminals of main switchboard	B	B	c	c	Suspend power
		7	Radio wave release test	B	B	c	c	
		9	Operation at top of radar mast	c	c	c	c	

Division			Type of Operation	Attester			Remarks
L		s	Contents of Work	Pre	In	Post	
	e	10	Operation on top of antenna post	c	c	c	
		11	Radar scanner installation	c	c	c	
		13	Initial running of auxiliary machinery	c	c	c	
		16	Steering gear start up	c	c	c	
		17	Engine room ventilation start up	c	c	c	
		18	Power source check during disconnection/ reinstallation of electric equipment	c	c	c	
		19	Use of fire after linings are installed	c	c	c	
			<u>Painting</u>				
		1	When paints containing inorganic sol- vents are applied by spray	B	B	B	Including touch up
		2	When paints containing inorganic sol- vents are applied by brush at places higher than 5 meters	c	c	c	
		4	When paints not containing inorganic solvents are applied by spray at places higher than 5 meters	c	c	c	

HULL FABRICATION SHOP WORK PROCESS STANDARDS

Titles

- o Carriage and trailer carnage loading process standard
- 0 Bent material bar, slinging process standard
- 0 Bent shell plating slinging process standard
- 0 Hydraulic press process standard
- 0 Hydraulic jack application standard
- 0 Surface plate jack pin application standard
- 0 2K Steel material yark slinging process standard
- 0 N/C Advance plate joining slinging process standard
- 0 N/C Slinging process standard
- 0 400-t Horizontal pressing hydraulic press process standard
- 0 ul250-t Horizontal pressing hydraulic press process standard
- 0 6K Flat bar cutting process standard
- 0 6K Multi strake planer application standard
- 0 Battery lift handling process standard
- 0 Gas leak prevention standard
- 0 Gas cutting operation, ignition/extinction process standard
- 0 Hull fabrication shop, in-shop, mandatory vehicle safety driving requirements
- 0 Steel plate reversing process (eagle clamp) standards
- 0 Conveyor application standard
- 0 Slinging wire selection standard
- 0 Lif-Mag (lifting magnetic) crane slinging process standard

Titles

- 0 Hooker check and control standard
- Wire rope check, discarding and control standard
- o Shackles check control standard
- Eagle clamp application and check standard
- o Standard for power cut-off of crane main trolley,
lubrication and check standard

ASSEMBLY/SHOP VDRK PROCESS STANDARDS

Titles

- 0 Gear type jack operation standard
- 0 Bent block distribution, material reception standard
- 0 Transport frame application standard
- 0 Slinging process standard
- 0 Handrail pipes check standard
- 0 Elevating ladder application standard
- 0 Scaffold metal pieces check standard
- 0 Stepladders application standard
- 0 Scaffold assembly process standard
- 0 Standard for Transport of scaffold planks by carriage
- 0 Standard for application of suspended pier for operation
- 0 Grinder (offset) handling standard
- 0 High frequency generator handling standard
- 0 bw voltage electricity handling standard
- 0 Lifting pad welding process standard
- 0 Color check process standard
- 0 Metal pieces welding procedure
- 0 Gas cutting safety operation standard
- 0 Erection job classification, tack welding, mask wearing standard
- 0 Reversing conveyor operation standard
- 0 Framed block lifting standard
- 0 Cantilever Crane application standard
- 0 Framing CO₂ unit application standard

Titles

- 0 Trans frame lifting pad application standard
- 0 SUB lifting pad installation standard
- 0 Erection apparatus and tools, handling and check standard
- 0 FC plate erection clamp operation standard
- 0 Collapsing device operation standard
- 0 Small block carriage loading standard
- 0 Battery charging process standard
- 0 Standard for power cut-off during crane trolley checks
- 0 Air winch operation standard
- 0 Trans frame grab device operation standard

PIPE SHOP WORK PROCESS STANDARDS

Titles

- 0 Pipe piece manufacturing process standard
- 0 Pipe coaster operation standard
- 0 Cold bending process standard
- 0 Pipe welding process standard
- 0 Grinding process standard
- 0 Pipe pallet operation standard
- 0 Pipe internal surface, oil flushing waste oil disposal standard
- 0 Pipe painting process standard
- 0 Pipe cleaning process standard
- 0 Nylon rope check application standard
- 0 Stepladder application standard
- 0 Welder shock preventing unit check standard
- 0 Welder check standard
- 0 High pressure line hydraulic test standard
- 0 Forklift trucks operation standard
- 0 Vinyl chloride tube manufacturing process standard
- 0 General Safety Manual
- 0 In-premises vehicle loading and traffic standard
- 0 CO₂ and TIG welding operation standard

WORK PROCESS STANDARDS

(GENERAL)

Titles

- o Penetrating metal piece installation process standard
- 0 Piping alignment installation process standard
- 0 Pipe sleeves installation process standard
- 0 Pipe support block application standard
- 0 Pipe installation bands application process standard
- 0 Vinyl chloride pipe installation process standard
- 0 Hydraulic test & water filling test process standard
- 0 Iron hardware installation process standard
- 0 Steel shelves for store, installation process standard
- 0 Square ventilation ducts penetration installation process standard
- 0 Square duct alignment and installation process standard
- 0 Ventilator installation process standard
- 0 Hull heat insulation installation process standard
- 0 Standard for control of slinging wires
- 0 Standard for application and checking gas hoses and gas burners
- 0 Gas cutting process standard
- 0 Standard for application of cab tire and electric welding process standard
- 0 High place operation standard
- 0 Up and down operation standard
- 0 Chain block application process standard
- 0 Tack welding process standard

Titles

- o Band installation standard
- 0 Fabrication standard of zinc plated articles
- 0 1?kdbble coupling installation (made of rubber)
- 0 Flexible coupling installation (stainless steel)
- 0 How to draft/sketch pipe piece drawing
- 0 Unit assembly (Part 1, Auxiliary machine & bases)
- 0 Unit assembly (Part 2, Tanks and the like)
- 0 Unit assembly (Part 3, Floor plate unit)
- 0 Loose pipe installation process standard
- 0 Advance check operation for internal & external
conversion of tanks after oil is loaded
- 0 Standard for application of packings
- 0 On-ground outfitting process standard
- 0 Advance ladder installation standard
- 0 Spring hanger installation standard
- 0 Handrail installation standard
- 0 Cut-out for floor plate valve covers
- 0 Instrumentation piping (Copper tubes) standard
- 0 Pressure gauge panel installation standard
- 0 Piping system hydraulic testing process standard
- 0 Auxiliary machinery base marking standard
- 0 Hull attached tank liquid level *gauge* installation *standard*
- 0 Piping system line check process standard
- 0 Auxiliary machinery piping system: Attachements installation standard
- 0 Shell plating attached washers installation (in case of on-board
installation) standard

SAFETY AND HEALTH MANAGEMENT PROGRAM CHART, 19XX

MONTH		1	2	3	4	5	6	7	8	9	10	11	12	Remarks
MAIN EVENTS	National Industrial Level		National S&H Emphasis Month				National Safety Week Preparation Month	National Safety Week		National Labor Health Preparation Month	National Labor Health Week			NFSMU: National Federation of Shipbuilding Workers Union
	Company Level		NFSMU S&H Check Patrol			Special S&H Preparation Month	Special S&H Check Month	NFSMU Safety Consciousness Uplift Month					Year End Safety Intensifying Month	
	Works Level	* Beginning of the year assembly of all employees				Kure area exchange patrol	Management & Union joint patrol			Kure area Health Exchange Patrol		Kure area Exchange Patrol	Management & Union joint patrol	
Monthly Priority Items		Pervasion of Powder dust Mask Wearing	Pervasion of fall, drop prevention action	Pervasion of crane lifting accidents prevention measures	Thorough checking of Machinery facilities	Pervasion of protective gear wearing	Pervasion of electric shock prevention measures	Pervasion of explosion, fire, toxicity accidents prevention action	Pervasion of fall, drop accidents prevention action	Health facilities check Work environment improvement	Handling accidents prevention action	Apparatus, tools, wires, hoses, etc., check & adjustment	Pervasion of housekeeping	D-1 Example of a Shipyard's S&H Program.
Various Campaigns, Etc.		Powder dust mask wearing campaign		Special safety monitoring team		Protection gear wearing campaign			Fall, drop accidents prevention campaign	Special safety monitoring team	Model work group system			
S&H Education	Supervisors					SSI follow-up education (2F)								
	General	By each operation line Each shop; safety work standard education	Health education Powder dust Oxygen lack		(Persons requiring special examination) Organic solvent; Special chemicals Noises Vibration, trigger gondola work re-education		High place					Lifting, winch, hoist handling, etc., re-education		
Health Diagnosis & Health Education, etc.	Health Diagnosis, & Health Control	Periodical examination Vibration/Organic/Lead examination					Dental			Periodical examination (every 6 months) Organic, lead, silicosis, hearing examination Adults' diseases exam.			Dental Health guidance for employees cautioned at adults' diseases examination	
	Health Education				Key workers at site mental health education									
Environment Measurement & Check, Etc.			Measurement of organic solvent, powder dust at work sites		Noise Measurement (1/Month)					Measurement of organic solvent, powder dust at work sites				
			Stretcher Check (1/Month)											
		First aid equipment check	First aid equipment check Extermination of vermin Blood donation				First aid equipment check			First aid equipment check Extermination of vermin			First aid equip. check	
Qualification Education (In-house Special Education)		Movable roof Construction lifts	Low voltage, Oxygen lack (CO ₂)	Hoists, Radio hoists	High place work units, Gondolas	Mobile cranes, Winches		Movable roof, Construction lifts	Low voltage, Oxygen lack	Hoists, Radio hoists	High place work units, Gondolas	Mobile cranes, Oxygen lack (CO ₂)		

SHIPYARD X SAFETY AND HEALTH PROGRAM
FOR YEAR 19XX

A. Basic Policy

1. Control the sources of accidents beforehand and provide counter-measures and instructions in advance.
2. Conduct safety operations thoroughly through daily actions and employee education by managers and supervisors.
3. Raise employees' consciousness of S&H and create an atmosphere which induces employees to spontaneously observe safety rules and to not disregard unsafe conditions.

B. Control Targets

1. Major Casualties0
2. Day-Off Casualty Ratio (DOCR)0.5 or less
3. Total Casualty Frequency Ratio (TCFR)4.0 or less
4. Intensity Ratio0.02 or less
5. Number of Sick Day-Off Ratio1.0% or less

C. Priority Management Policy

1. Instill the will to prevent group casualties:
 - a. Thoroughly check in advance, work which involves risks of fire, explosion, poisoning, asphyxiation, etc. and provide positive casualty preventative measures
 - b. Instill knowledge about and carry out fire-use permission standards and coordinate activities when different types of work must take place in the same space at the same time.

2. Drastically reduce accidents by falls:
 - a. Provide directions for the use of safety belts and educate workers in the use of safety belts.
 - b. Provide means to prevent falls from even medium and low heights and employ good lighting at work sites.
 - c. Disseminate safe and easy methods for assembling and disassembling scaffolding and lifting gear.
3. Instill knowledge of S&H education and insure pertinent implementation:
 - a. Carry out Supervisor Safety Training (SST) follow-up education and disseminate specific safety work instructions.
 - b. Carry out safety education for workers using S&H educational texts and safety work-process standards pertinent to each section.
 - c. Raise the consciousness of S&H and foster the custom of safe behavior through various campaigns.
4. Accomplish Health Control:
 - a. Promote physical strength through exercises, e.g., rope skipping, body stretching, etc.
 - b. Take thorough after-care of employees needing health control by providing health-care guidance and classes.
 - c. Educate workers in the wearing of protective gear and improving work environments.
5. Analyze work methods, work environments, etc. and thoroughly investigate, in advance, the sources that lead to casualties:
 - a. Organize a safety monitor team to carry out analysis of specific work processes, and devise and implement appropriate counter-measures.
 - b. Accomplish safety design and pre-project planning.
6. Strengthen control systems for new in-house facilities and/or machinery projects, and carry out thorough pre-project planning and education.
7. Carry out thorough inspections on old machinery and facilities based on check lists, and have specialists make pertinent adjustments as determined by the checks.

APPENDIX E

HULL ERECTION SECTION SAFETY AND HEALTH PROGRAM

A. Basic Policy

"Respect for human life" is the basic doctrine. Through the following programs, establish an accident-free and comfortable job site.

1. Perfect the S&H management system.
2. Plan in advance a safety program that matches each project to be undertaken.
3. Provide safety instructions that exactly match work processes to be employed for a project.
4. Instill a sense of professionalism among workers with emphasis on good discipline.

B. Targets

1. Zero major casualties.
2. Zero day-off casualties.
3. Non day-off casualties: two cases or less.
4. Number of sick-days off: 0.807 (817 days) or less.

"Become the leader of an outdoor area in discipline and safety."

C. Method of Operation

1. Implement monthly "Priority Safety Items" (see Pages E-1 and E-2) in line with the check items defined for each job classification.
 - a. Use a bulletin board or blackboard to deliver safety instructions for specific job sites and work methods.
 - b. During safety meetings, ensure that workers fully understand check items.
 - c. When making checks, also determined that the check items are being properly observed.
 - d. Patrol work sites to confirm implementation of priority items.
2. Raise morale through disciplines that encourage a spirit of professionalism.

PRIORITY SAFETY ITEMS IMPLEMENTATION PLAN

January, 19XX
Erection Section
Hull Construction Department

A. Shipyard Events

1. Assembly of all employees at the beginning of each year.
2. Powder/dust mask wearing campaign.
3. Education for handling portable shelters and construction lifts.

B. Priority Safety Items

1. Instill the use of masks.
2. Prevent casualties caused by careless behavior.

C. Implementation Procedure

1. Insure that all employees are made aware of yearly safety targets.
2. Following Monday meetings convened by foremen, check to determine if workers possess masks.
3. At the Safety Meeting (January 10, 1:00 p.m.), confirm safety targets the year and review accidents and casualties that occurred during the previous year.

D. Primary Check Points During Shop Patrol

1. Check the status quo for mask wearing.
2. Check each workers behavior while work is in progress.
3. Check the status of footholds in ships' engine rooms.

PRIORITY SAFETY ITEMS IMPLEMENTATION PLAN

February, 19XX
Erection Section
Hull Construction Department

A. Shipyard Events

1. National Safety and Health Emphasis Month.
2. National Federation of Shipbuilding and Heavy Machinery Workers Union Safety and Check Patrol.
3. Education to obtain qualification for installing/repairing low voltage circuits and/or working in places that lack oxygen.

B. Priority Safety Issues

1. Prevention of Falling/Dropping Casualties.

C. Implementation Procedure

1. Check status of wearing safety belts (February 4 and February 18)
2. Check the use of bulletin boards and blackboards. Determine whether the boards are conspicuously located in frequented places and what instructions or notices are displayed.
3. Safety Meeting (February 8, 1:00 p.m.). Using a check list, explain priority safety items for each job.

D. Primary Check Points During Patrol

1. Check whether subblocks, blocks, etc. are placed in a stabilized condition.
2. Check whether staging, guard rails, etc. are properly installed and note who is responsible for such installations.

SAFETY CHECK ITEMS BY JOB CLASSIFICATION

Priority Safety Item: Prevention of Falling/Dropping Accidents

No.	Check Items	Erection: Steel Bending	Welding	Fitting Slinging	Finish	Painting	Block: Water Filling
1	Adequate use of lifelines	x	x	x	x	x	x
2	Check stability of ladders and steps before ascending and descending	x	x	x	x	x	x
3	Check display of caution board indicating "WORK UNDER WAY ON HIGH PLACES"	x	x	x	x	x	
4	Check lashing of ladders	x	x	x	x	x	x
5	When cutting structural members check below and opposite side. Display "'CAUTION OVERHEAD" at bottom of dock or slipway.	x			x		
6	Strictly carry out routine check of gondolas	x	x		x		
7	Perfect observation of safety standards when using work unit for high places	x	x		x		
8	Pervade practice of lashing	x	x				
9	When using mini-hoists, be sure to wear life lines. Clear person underneath	x	x	x	x	x	x
10	Check safety installing or re-locating stages (Foreman)	x		x			
11	Check lifting blocks before lifting			x			
12	Do not leave scrap materials	x	x				
13	Submit report of results of implementation of priority items		(Asst. Foreman)		x	x	x